

SCIENCE

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FRIDAY, MAY 8, 1896.

THE DEDICATION OF THE NEW SITE OF
COLUMBIA UNIVERSITY.

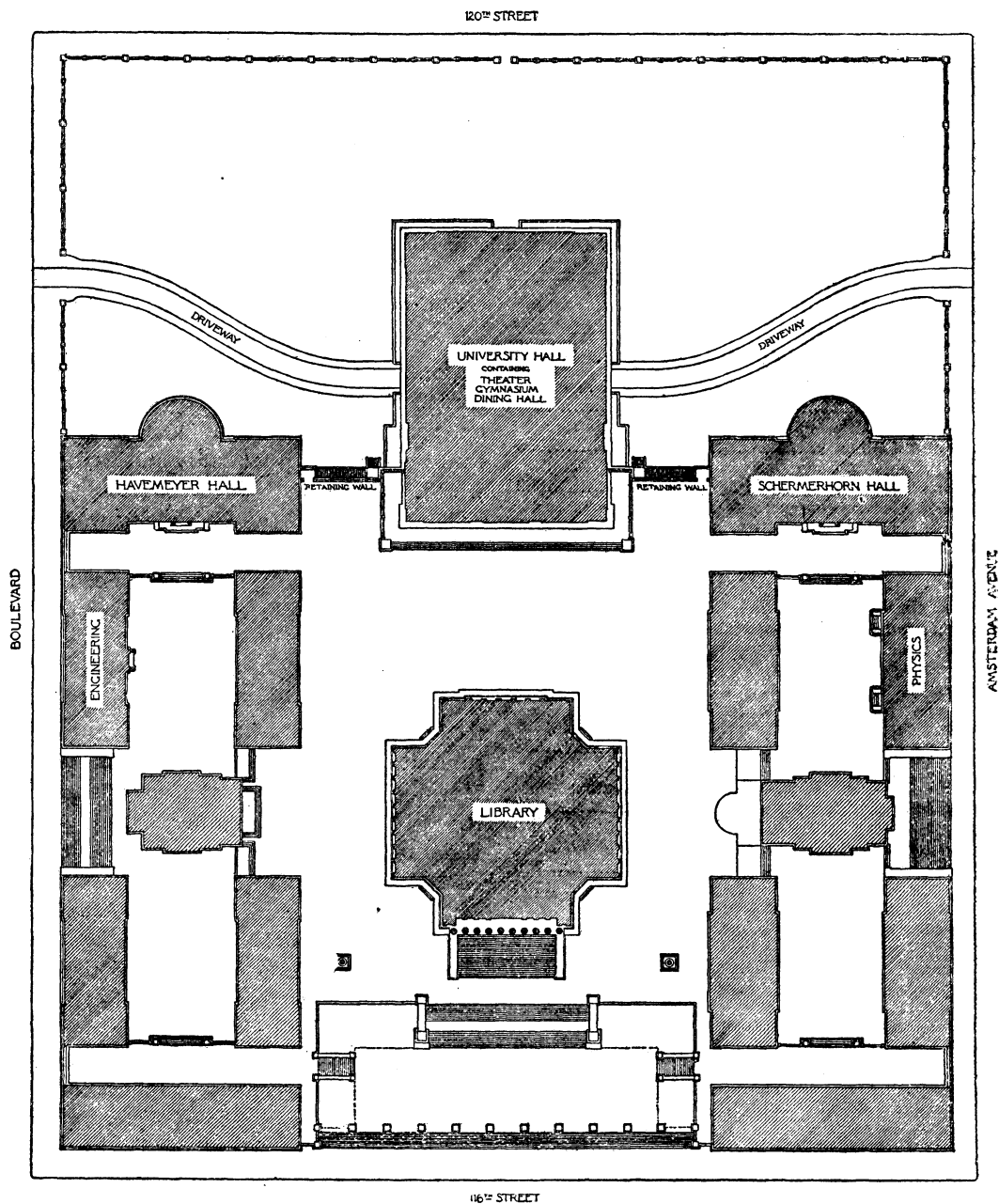
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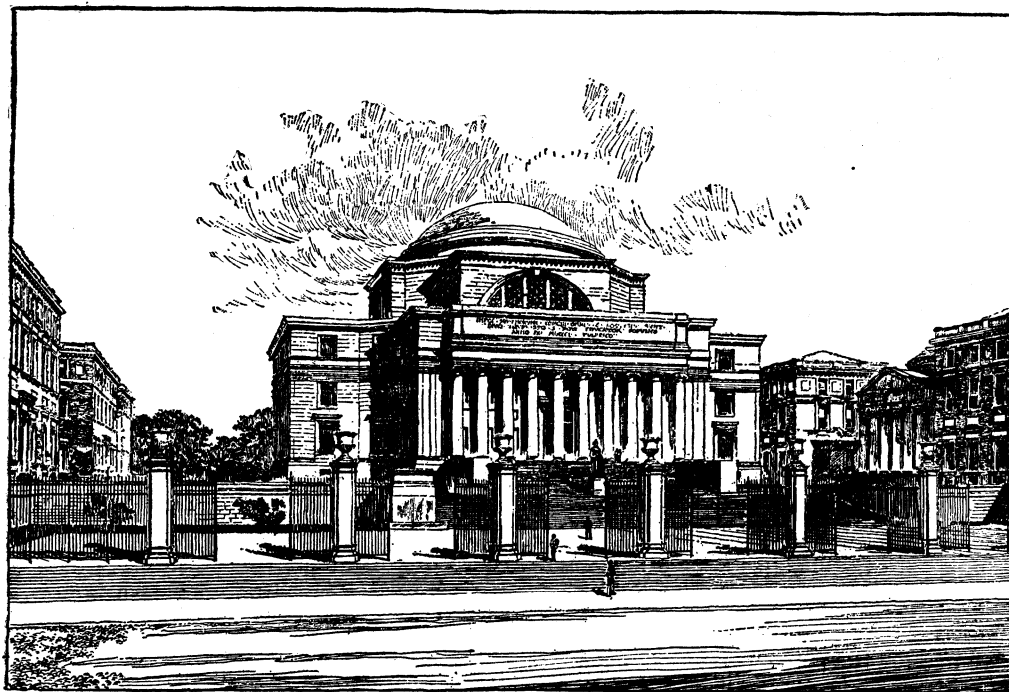
COLUMBIA UNIVERSITY has under President Low become a university in name, in externals and in fact, and henceforth takes rank with the great universities of the world.

The new site of the University was dedicated on May the second with ceremonies worthy of its stately buildings in course of erection and of its commanding position above the City of New York. The site of the University, occupying somewhat more than seventeen acres and purchased by the trustees at a cost of \$2,000,000, is on the summit of Morningside Heights, between Morningside Park on the one hand and Riverside Park on the other. On the same Heights and adjacent to the University will be the Cathedral of St. John the Divine, St. Luke's Hospital, Grant's Mausoleum and, affiliated with the University, Barnard College and the Teachers' College.

As is shown in the accompanying figures, the Library Building, erected as a memorial of Abiel Abbot Low, by his son, President Low, occupies the central and most elevated position. The basement of Milford granite and the first story of Indiana limestone, already erected, indicate the plan and architectural character of the building. It is classic in style, in the form of a Greek cross, surmounted by a dome. Its width is 192 feet and the height of the dome will be 135 feet.



PLAN OF THE NEW BUILDINGS AND GROUNDS.



THE LIBRARY OF THE UNIVERSITY.

The Library Building, as the other buildings and their arrangement, has been designed by Messrs. McKim, Meade & White, under the immediate supervision of President Low.

In the rear of the Library Building, the basement being on a lower level, will be the University Building, for which the foundations are being prepared. The southerly portion of the building, facing the library quadrangle, is designed as a Memorial Hall. Connecting with the Hall and on the same level will be the University Theater, with a seating capacity of 2,500. There will be a Gymnasium under the Theater, and the engine rooms will be under Memorial Hall. On public occasions the entire building can be used.

Plans have been prepared for Havemeyer Hall, erected as a memorial of Frederick C. Havemeyer for the department of chemistry,

and the Engineering Building, and these will soon be in course of erection.

The foundation stones of the Physics Building and of Schermerhorn Hall were laid on May 2. The Physics Building will ultimately be devoted entirely to the department of physics, but for the present will also be used for related sciences. Schermerhorn Hall, the gift of Mr. William C. Schermerhorn, the chairman of the trustees, will be devoted to the natural sciences and will contain the departments of mineralogy, geology, paleontology, botany, zoölogy and psychology. These buildings are to be built of the over-burned brick of a dull-red color, generally known as Harvard brick, and of Indiana limestone. In style they are in keeping with the Library, and represent to some extent a reversion to the best construction of the Colonial period.

To the east and west of the Library will be the Chapel and the Assembly Hall for the use of students, while the other buildings indicated on the plan will be built as required for special purposes.

At noon on May 2d the corner stones of the Physics Building and of Schermerhorn Hall were laid in the presence of the officers and alumni of the University. The corner stone of the Physics Building was laid by Professor Ogden N. Rood, and an address was made by Prof. Howard Van Amringe, who traced the growth of the College, with special reference to its scientific departments, from the time when the first corner stone of the first building of the College was laid, 140 years ago. At that time the teaching force of the institution consisted of the President and one tutor. The speaker called attention to the fact that the first buildings to be built for purposes of instruction and research are for the sciences.

The corner stone of Schermerhorn Hall was laid by Mr. W. C. Schermerhorn, the donor of the building, and an address was made by Prof. Henry F. Osborn, in the course of which he said that the problem of the last twenty years had been the establishment of universities. The problem of the next twenty years is the production of thinkers of the highest type. The building should be laid on the corner stones of breadth, height, energy and repose. Breadth, standing for thoroughness of preparation and wideness of horizon; height, for specialization; energy, for determination in the prosecution of research; and repose, for undisturbed observation, reflection and induction. It is the symmetrical and balanced development of all these factors which will make Schermerhorn Hall a birthplace of discoveries, a permanent monument to its generous founder, worthy of Columbia University, and a new force in American science.

At three o'clock in the afternoon the site

was dedicated with impressive ceremonies, held in a large pavilion, in which 3,000 people were seated. In addition to the officers, alumni and students of the University, there were present the Governor of the State, the Mayor of the City, Presidents and representatives of the leading American universities and colleges, and many other distinguished guests.

President Low made the opening address, calling attention to the fact that historic ground would be dedicated to a new use. Already it is twice consecrated. In the Revolutionary War the soil drank the blood of patriots, willingly shed for the independence of the land. Since then, for three generations, it has witnessed the union of science and of brotherly kindness, devoted to the care of those suffering from the most mysterious of all the ills that flesh is heir to. To-day we dedicate it, in the same spirit of loyalty to country and of devotion to the services of mankind, to the inspiring uses of a venerable and historic university. It is no small part of the suitability of this site for the uses of the University that it here will find itself in the inspiring presence of so many other forces that make for the uplifting of the city. If New York is taunted in the years to come with being a city wholly given up to the love of money, she may well point to this eminence, with its cathedral, its hospital, its educational institutions, its monument to Gen. Grant, and say: "These are my jewels: religion, philanthropy, education, patriotism; these are the things my children care for more than they care for money; therefore I wear these things in my civic crown."

A national flag was then presented to the University by Rear Admiral Meade on behalf of Lafayette Post, Grand Army of the Republic, and a dedication ode in Latin, written by Prof. Peck, was sung.

Hon. Abram S. Hewitt, an alumnus of

the University, made an address reviewing the work of the University in relation to the social and political growth of the city. The last speaker was President Eliot, who, in the name of the universities of America, congratulated Columbia University on its setting commensurate with the worth of its intellectual and spiritual influence.

PSYCHOLOGICAL NOTES UPON SLEIGHT-OF-HAND EXPERTS.

THE determination of the influence of special kinds of occupation and training upon the delicacy, range and quickness of sensory, motor and mental powers is an important and interesting problem. Observations of this kind must first be directed to the determination of the average capabilities of average individuals and then be extended by a study of the influences of age, sex, heredity, training and a multitude of other factors upon the growth and perfection of special powers. Last of all will come the study of small, special groups of persons and of the individual himself. At all times, however, an individual with exceptional powers in any direction is quite certain to attract attention and arouse interest; psychological tests made upon such virtuosi are desirable, even if in individual cases they suggest no very decided conclusions.

Having recently enjoyed visits at my Psychological Laboratory from Messrs. Hermann and Kellar, the widely-known prestidigitators, I put together the results of the series of tests to which they kindly submitted. As the time at my disposal for these tests was limited, I selected such as might be supposed to be related to the processes upon which their dexterity depends, and such as seemed most likely to yield definite results.

Beginning with tests of tactile sensibility, I determined the distance at which two points of an aesthesiometer placed upon the

forefinger of the right hand could be recognized as two. This distance was for Mr. Hermann 3.5 mm. and for Kellar 2.5 mm. A comparable average result, obtained from a considerable number of miscellaneous individuals, was about 2 mm., indicating a somewhat coarse sensibility for the two special subjects. The attempt to arrange in their correct order a series of 5 weights increasing by $\frac{1}{15}$ of their weight was unsuccessful in the case of Mr. Hermann, but was successfully carried out by Mr. Kellar. The attempt to arrange weights differing by $\frac{1}{30}$ was entirely unsuccessful for both of them. In a general series of tests, 92% of those tested arranged the former series correctly, and 66% the latter. The weights were estimated by lifting them between thumb and forefinger. A test of sensitiveness to textures was also made. The fingers were passed across a surface composed of wires wound closely side by side. Mr. Kellar was tested with a series in which each surface was $\frac{1}{4}$ coarser than its neighbor, and with one in which the differences were only $\frac{1}{8}$. He arranged the first correctly, but was entirely mistaken in the arrangement of the second. Mr. Hermann tried only the finger differences which he also failed to arrange properly. I next tested the same sensibility by having the subject feel between the thumb and forefinger, as in feeling the thickness of paper, a set of single wires of various calibres, mounted upright on wooden blocks. In one series the differences were $\frac{2}{7}$, in another $\frac{1}{7}$. Both Mr. Hermann and Mr. Kellar succeeded in arranging both series correctly, but this was also done by 9 out of 10 persons who were tested in the same way. Still another form of tactile and motor capacity was tested by requiring the subject to arrange in order a series of bars of varying length by passing the forefinger across them. Both Mr. Hermann and Mr. Kellar passed this test successfully in the series varying by $\frac{2}{15}$ of their average length;

but when the series varied by only $\frac{1}{15}$ Mr. Kellar made one slight mistake, and Mr. Hermann's arrangement was correct. The former task was successfully accomplished by 60% and the latter by 50% of a large group of persons similarly tested.

As both Mr. Hermann and Mr. Kellar have made themselves by persistent training quite ambidextrous, being able to perform sleight-of-hand tricks with either hand (although both are naturally right-handed), it is interesting to record the results of the attempt to move the two hands equally far from a common starting point. For Mr. Hermann, in single excursions, the right hand moved 318, 330, 123, 302, 116, 260 mm.; while the left hand moved 316, 344, 140, 268, 160, 225 mm. The average right-hand movement was 241.5 mm; the average left-hand movement 247 mm. In three cases the left-hand movement was distinctly longer, in one case the right hand was distinctly longer, and in two cases they were nearly alike. The two hands did not move very well together, but there seems to be no constant error in one direction. The average excess of the left hand is 5.5 mm. while the general average for those who have the same tendency is 13.75 mm. It may be added that, in general, about an equal number of persons would have the tendency of moving the left farther than the right as would have the tendency of moving the right hand farther than the left. A similar record for Mr. Kellar was: right hand 281, 357, 404, 155, 108, 313, mm.; left hand 268, 333, 411, 187, 133, 337 mm. This makes an average excess for the left hand of 8.5 mm., the average right hand movement being 270 and left hand 278 mm. Differences of the two hands are nowhere large, the excess of the left hand appearing in four of the six movements. The next test consisted in marking off, by a movement of the arm (the eyes being closed) five equal distances, by raising a

pencil from a strip of paper and bringing it down again. The average deviation of these movements from one another was for Mr. Hermann 16.1 % of their average length, for Mr. Kellar 5 % in his first trial and 12.6 % in his second. The general average deviation for this test was 11.8 %.

A few tests of the accuracy of visual perception were made as follows: A line 100 mm. long was to be divided in half. For Mr. Hermann the left half measured 49.75 mm.; for Mr. Kellar in his first attempt 50.75 mm., in his second attempt 52.2 mm. The average error in this test is about 1.75 mm. The same line when divided into three equal parts resulted as follows: For Mr. Hermann, left 33, middle 34, right 33 mm. For Mr. Kellar, in the first attempt, left 35.5, middle 34.5, right 30 mm.; in the second attempt, left 33, middle 35.5, right 31.5 mm. The general average record for this test was, left 32.0, middle 34.5, right 32.7. The subjects were next required to mark off on the three arms of a cross, a distance equal to that (50 mm.) marked off on the upper arm of the cross. The lengths of the arms were unequal and the cross asymmetrically placed on the paper. For Mr. Hermann the left arm was 70.5, right arm 44, lower arm 60.5 mm. This large error can only be accounted for by the confusion of the distance from the center outwards with that from the margin of the paper inwards, but the possibility of such a confusion is not indicative of an accurate observation. Mr. Kellar's result was, in the first attempt, left arm 54.5, right 52.5, lower 50 mm.; second attempt, left 55.5, right 54.5, lower 51 mm. The average results of a large group of individuals in this test were left 54, right 54, lower 61 mm. Mr. Kellar's error for the lower arm is thus less than the average one. Another test of visual perception is called the 'form alphabet.' It consists of 25 characters composed of short and long vertical and horizontal strokes in various

combinations. 215 of these are printed upon a sheet in miscellaneous order. A certain one of these is singled out for identification and the subject is required to indicate as many occurrences of this character as he can detect within a limited time (90 seconds). In the first attempt Mr. Hermann did not fully comprehend what was wanted, marking off 10 right and 19 wrong ones. In the second test he marked off 8 correct ones. Mr. Kellar marked off 7 correct ones in the first attempt and 11 in the second. The general average of persons succeed in recognizing about 8 forms in this time.

Quite a number of tests of the quickness of movement and of mental processes were made. For Mr. Hermann the maximum number of movements of the forefinger alone was 72 in 10 seconds, or 7.2 per second, and of the forearm 75, or 7.5 per second. For Mr. Kellar, forefinger 83 in 15 seconds, or 5.5 per second, and for the forearm 127, or 8.2 per second. The average of a large number of individuals for the forefinger movement was 5.4 per second, and of a group of ten persons, tested more nearly in the same way as were Messrs. Hermann and Kellar, 4.8 per second. The average forearm movement of the same ten persons was 7.5 per second. It thus appears that the movements for both Mr. Hermann and Mr. Keller are rapid; Mr. Hermann's forefinger movement being exceptionally so, while Mr. Kellar's forearm movement is the better.

Passing to the ordinary forms of reaction experiments, Mr. Hermann's reaction to a touch upon the right hand was remarkably short, especially for one who had never been a subject for reaction experiments before. The average of 6 trials was 104 σ ($\sigma = \frac{1}{1000}$ second), with an average variation of 11 σ . Mr. Kellar's time was 129 σ , with an average variation of 10 σ . For sound reaction the time was: Hermann 163 σ , vari-

ation 32 σ ; Kellar 116 σ , variation 25 σ . For visual reaction, Hermann 126 σ , with variation of 26 σ , or omitting one irregular result, 111 σ , with variation of 8 σ ; Kellar 125 σ , variation of only 6 σ . For a considerable group of average individuals, reacting for the first time, the following numbers have been found: For touch, 172 σ ; sound, 165 σ ; sight, 176 σ . It thus appears that both of the special subjects tested react far more quickly than the average individual. Another form of reaction involving manual quickness of movement was arranged as follows: Two keys were placed three feet apart, and the time measured that elapsed between the touching of one and a movement over to and touching the other. Mr. Hermann's time for this reaction was 610 σ , with a variation of 76 σ ; Mr. Kellar's time was 299 σ , with a variation of 23 σ . The average of ten individuals making the same test was 364 σ , with an average variation of 32 σ ; but these ten individuals show considerable variation amongst one another. Mr. Kellar's time is thus somewhat below the normal, although it is equalled by 6 of the 10 persons tested, while Mr. Hermann's time is unaccountably long. As a type of reaction involving a choice, the distinction of red and blue, associated with movements of the right and left hands, was selected. In this Mr. Hermann's time was 301 σ , with a variation of 64 σ ; Mr. Kellar's time, 256 σ , with a variation of 56 σ . For a simpler choice I have an average record of 259 σ , and for the same reaction the average of 10 individuals is 297 σ , with an average variation of 44 σ .

A more complicated reaction involved a movement with any one of the five fingers in response to the appearance of the numbers 1, 2, 3, 4 or 5 behind the opening in a screen. Mr. Hermann's time for such a reaction was 901 σ , with a variation of 200 σ ; Mr. Kellar's time being 753 σ , with a variation of 91 σ . The average time of 10 indi-

viduals for such a reaction is 588 σ , with a variation of 84 σ . It is thus quite clear that, while the simple reaction time for the two special subjects is much shorter than the normal, their time is just about normal in a reaction involving a simple distinction and choice, and is considerably longer than the normal in a reaction involving a complex distinction and choice.

The incident related of Houdin, the 'king of the conjurers,' regarding his remarkable powers of taking in at a glance the miscellaneous contents of a shop window, suggests another power of great use to the prestidigitator. Mr. Hermann claims to possess a similar power, although he does nothing in his stage performances that demands such a comprehensiveness of perception. I exposed for $\frac{1}{2}$ a second 10 patches of color requiring him to name as many he could see; in each of two trials he named five correctly. When the color patches were different in shape as well as in color he was able to see three in $\frac{1}{2}$ a second and describe them correctly. He was also able to read two words in the same time. I also counted the number of consecutive exposures of $\frac{1}{2}$ second each needed for the reading of a sentence containing 17 words; it required 10 exposures or 1.7 words per exposure. In one-second exposures Mr. Hermann could read 3 isolated words, and required 8 exposures to read a sentence of 29 words or 3.6 words for each exposure.

Similar averages for a group of about 40 persons indicate about the same quickness of perception for color 4.5 as compared with 5; an inferior perception for combined color and form 1.8 as compared with 3, only 12% of those tested recognizing as many as three color forms; and likewise for words seen separately 1.4 as compared with 2 (22% reading 2 words), but a distinctly higher average of the number of words read in one exposure. On the whole, these few

experiments would indicate that, as regards the quickness and scope of perception, Mr. Hermann would rank well (except in reading words in a sentence); but by no means exceptionally well in the general average.

For Mr. Kellar the tests were somewhat differently arranged. The patches of color and the various forms were arranged consecutively and were read in order as one would read words on a line. In exposures of one second Mr. Kellar could read correctly four colors and three forms. In reading words scattered over the page he read 2 correctly in his first trial and 3 in second trial. In four successive exposures of 1 second each he read a sentence containing 27 words, or an average of 6.75 words per second. Mr. Kellar would thus rank below Hermann in all but the reading of words in a sentence, in which he far exceeds him, but would be equalled by about 86% of a group of college students.

Another form of testing this capacity was attempted, but with no success. Mr. Hermann was shown 10 pictures, and asked to study them for about 45 seconds; he was then shown a card containing 40 pictures and requested to mark off which of the 40 were also seen on the former card. He marked off 7, 4 of which were correct and 3 wrong. For Mr. Kellar this test was more systematically made. He was shown a card containing 40 pictures and at the same time a slip containing 10 words, the names of a certain 10 of the pictures; and asked to find the pictures named by the words as rapidly as possible. This took him just 45 seconds, the average of a miscellaneous group of individuals being 64 seconds. A few minutes later he was asked to note on a card containing 60 pictures as many as he could remember having seen on the former card containing 40 pictures. He succeeded in recognizing but 11, the average in this test being 17.5 pictures. I also tested Mr. Kellar's visual memory by

having him look at a series of words for about 5 seconds, and then repeat as many as he could in correct order. He succeeded in repeating correctly 5 out of a series of 6 words, and 6 out of 9 words. For a similar series of numbers his memory was much better. He could repeat 7 numerals correctly, and in attempting to repeat a set of 10 made but 2 errors. This is better than the average, but not remarkably so. It should be added that several very striking performances are given by Mr. Kellar in which memory forms a considerable part. It is, however, a very special form of memory, involving the formation of accurate associations and classifications rather than an extended series of impressions.

If we now select those tests in which the records of Mr. Hermann and Mr. Kellar differ markedly from the normal we find as follows: In the quickness of response to a touch and a visual stimulus both the special subjects, and Mr. Kellar as well in response to an auditory stimulus, excel to a considerable extent the average individual. But this quickness of reaction does not appear in the more complicated reactions; and in the most complicated reaction they both fall considerably below the normal. In the quickness of movement we find decided indications of an unusual quickness for both Mr. Hermann and Mr. Kellar. In the scope and accuracy of visual perception we find in part a good record, but on the whole no very decided excellence appears. In tests involving mainly tactual perception and muscular perception, the indication is rather that they are below than above the normal. I might also add that I have repeated a few of these tests upon a local sleight-of-hand performer, and find for him a good record and particularly a great quickness of movement. This is perhaps to be explained by his facility in musical execution as a pianist and organist as well as in sleight-of-hand performance.

The positive results of the investigation are thus small, but as far as they go they are consistent with the forms of dexterity that are utilized in sleight-of-hand performances. They also indicate that it may well be that special skill in one very specialized form of training may be only slightly influential upon other forms of capacity. So little is known of the correlation of powers of this kind, and small series of tests are so apt to be affected by accidental errors, that any suggestions which the data seem to warrant must be put forward with great caution. The individual is interesting, but the methods of research are, and must be, particularly adapted to statistical groups.*

JOSEPH JASTROW.

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*THE INFLUENCE OF CARBON DIOXIDE
ON THE PROTOPLASM OF LIVING
PLANT CELLS.*

THE history of investigation of the relations of plants to the component gases of atmospheric air and with special reference to CO₂ may be said to begin with the researches of Priestley and Ingenhousz (1779). Among the results obtained by the latter was the fact that plants die in 'air' fatal to animals, and that such air contained large portions of CO₂. De Saussure next made his famous tests of the effects of the atmospheres containing various proportions of CO₂ upon growth (1804), and John found that peas would not germinate in an atmosphere of this gas, and since the seeds were killed by the alcoholic fermentation accom-

* I feel that it is necessary to add that Mr. Hermann perhaps did not do himself justice in some of the tests. He was always quick, confident and decided in his judgments, often performing a test in half the time taken by the average person. He was much interested in the tests, but seemed confident of his ability to do what was required, with little effort. It may well be that with a little more deliberation, and an opportunity of even a brief familiarity with the tests, better results could have been secured.

panying the experiments he concluded that the gas was poisonous to plants (1810). About this time Davy obtained some results confirmatory of those previously attained by De Saussure.

No further important facts were brought out until forty years later when, in the period of activity following the discovery of protoplasm, its relation to carbon dioxide were taken up by Kabsch, in a study of its influence on 'sensitive' plants (*Bot. Ztg.*, 1862). The field attracted many workers of the first rank among whom are Kühne, Boussingault, Pfeffer, Schützenberger, Godlewski, de Vries and Boehm, who paid chief attention to the influence of the gas in varying pressure and proportion upon the synthetic activity of chlorophyll-bearing plants. The discovery of Pasteur that certain forms of *Saccharomycetes* and *Schizomycetes* might live in a medium devoid of oxygen, was followed by the experiments of Frankel, in which he found that many forms of these groups might live in an atmosphere of pure CO_2 , and that the relations of each form to the gas was entirely specific (1889). D'Arsonval, pursuing similar lines of experiments, met no organism capable of continued existence in this gas at high pressures, forty-five atmospheres (1891). Frankland obtained results entirely in harmony with those of Frankel and further found not only great specific differences in resistance to the gas, but also wide differences in individuals from the same colony (1889). Demoor in some recent work upon the subject in connection with the effects of many different gases reaches the conclusion that the activity of the plasma is possible only in the presence of oxygen, while the nucleus may not be affected by conditions which inhibit the action of the plasma.* Perhaps the most extensive and exact series of experiments dealing with the relations of CO_2

to protoplasm devoid of chlorophyll is that recently carried out by Lopriori at Berlin.* This writer used gas obtained by heating potassium bicarbonate, according to the method of Schloesing and Laurent, which was stored in gasometers of special design, and the integrity of all mixtures was confirmed by numerous analyses. The microscopical examination was made in chambers similar in principle to that of Engelmann. Among his more important results are those which concern the accommodation of protoplasm to the unusual proportions of the gas and the germination of spores under such conditions. The streaming movement in the stamen hairs of *Tradescantia* was inhibited by exposure to a mixture of 20 parts oxygen and 80 parts CO_2 for 3 or 4 minutes, and was resumed after a minute's exposure to the air. A second exposure to the same mixture a half hour later had no effect on the movement, and a much greater proportion of CO_2 was now necessary to influence the rate of movement. By immersion of the hair in successive mixtures of the following composition :

- | | | | | |
|----|---|----------|---------------|----------|
| 1. | O | 25 parts | CO_2 | 75 parts |
| 2. | " | 20 | " | 80 |
| 3. | " | 10 | " | 90 |
| 4. | " | | " | 100 |

it was possible to maintain the movement in the pure gas.

The germination of spores of *Mucromucedo* was totally inhibited in pure CO_2 and delayed a varying length of time in mixtures containing high proportions. The myceliæ formed in mixtures containing above 10-30 parts of CO_2 did not develop sporangia. In such instances the protoplasm became highly vacuolar, while globular swellings were formed on the myceliæ sim-

**Arch. d. Biol.*, 13: 163. 1894.

* Ueber die Einwirkung der Kohlensäure auf das Protoplasma der lebenden Pflanzenzelle. *Jahrb. f. wiss. Bot.* 28: Hft. 4. 531-625. 3 Figs. 2 Pls 1894.

ilar to those resulting from the use of concentrated nutritive solutions. If such structures were brought into atmospheric air vegetative myceliæ were formed. Spores which had been immersed in pure CO₂ for three months germinated in the usual manner. In confirmation of Brefeld's work, Lopriore finds that *Saccharomyces* will not grow in pure CO₂, although but one-six thousandth part of oxygen is necessary as has been found by Brefeld. After 12 hours' immersion in the pure gas growth was resumed upon access of atmospheric air. Mixtures containing large proportions of CO₂ exerted a much stronger adverse influence upon *Mycoderma cerevisiæ*, which was killed by twelve hours' exposure to the pure gas.

Pollen grains reacted to mixtures in the most varied manner. Some formed protuberances in the pure gas, and then burst; in others no change was visible, while in others disintegration shortly ensued. Tubes formed in air and exposed to pure CO₂ were generally quickly destroyed. Proportions of 1 to 10 parts of CO₂ promoted the growth of the tubes, but did not increase the turgidity, which, however, was markedly increased if afterward brought into ordinary air. It will be remembered that in pollen tubes growth-extension of the walls is practically independent of turgidity. In many instances important changes in the plastic and elastic extensibility of the cell wall were induced, in a manner similar to the effects of strong oxygen solutions.

The results of Lopriore's work point to the conclusion that CO₂ exercises a retarding influence upon the activity of protoplasm, while directly exposed to it, but has no permanently injurious effect. Different plant cells exhibit widely divergent reactions to the gas. It appears quite well established that animal protoplasm is affected much more strongly by increased proportions of the gas. The influence of the gas

upon the protoplasm of plant cells is characteristic, and its effects do not result from the simple exclusion of oxygen; its action is upon the nutritive processes, and since the widest disproportion exists between the volume and the effect produced, if it exercises any stimulating influence the reaction must be so limited as to be easily obscured.

The establishment of the fact that CO₂ exercises a positive influence upon protoplasm makes necessary a revision of some of the conclusions reached concerning ærobie and anærobie organisms, and particularly the researches of Correns (*Flora*, 1892) upon the relations of plants to oxygen, in which oxygen was partly or entirely displaced by CO₂. The anomalous reactions of tendrils obtained by this author seem to be capable of explanation in view of the recently discovered relations of the gas to plant protoplasm.

D. T. MACDOUGAL.

THE STATE UNIVERSITY OF MINNESOTA.

NOTES ON CERTAIN UNDESCRIBED CLAY OCCURRENCES IN MISSOURI.

THE geologically well-known clays of the State of Missouri (which are very abundant and widely known, commercially), occur in the Quaternary—chiefly confined to the loess deposits along the larger rivers; in the Tertiary—in the southeastern part of the State; and in the Coal Measure formations—in the extension of the Iowa Coal Basin southwestwardly, and also in the small outlier of the Illinois Coal Basin, which is confined, practically, to St. Louis city and county.

Another interesting and commercially valuable group of clays, which has, apparently, never been described, includes a large number of more or less isolated pockets of fire clay and 'kaolin,' occurring unconformably in cavities and former valleys among the Silurian and, possibly, in some Devonian and Lower Carboniferous rocks. These pockets of clay are distributed over

a number of counties ranging, inclusively, from St. Charles, Warren, Montgomery and Callaway counties (which lie west of St. Louis), on the north; through Jefferson, Franklin, Gasconade, Osage and Maries, to Crawford, Phelps and possibly other counties on the south, the whole area occupying about the center of the eastern half of the State, its northern boundary being but a few miles north of the Missouri river.

These clays are of uncertain geological age. The beds of clay as they now occur are probably the last remnants of a once very extensive formation in this region. They are to be found mostly in the minor lateral valleys along the borders of the greater ones, and apparently always near the tops of the valley sides. They sometimes occur in shallow pockets along the tops of the divides, this being especially noticeable in Gasconade county, where these clays occur over a wide area. The greatest thickness of this clay seen by the writer, was at Regina, Jefferson county, where a pocket had been opened to a depth of sixty feet. Borings have been made in pockets which seem to belong to this class, which penetrated the clay to a depth of one hundred and twenty-five feet. In all of the many pits of this sort observed the contact between the clay and the surrounding sandstones or limestones was sharply unconformable, and indicated the origin above suggested.

The clay is usually cream-color, but is often mottled with purple and reddish tints, which are organic stains and readily disappear on ignition. It is mostly hard and brittle, breaks with a conchoidal fracture, and weathers concentrically, breaking up indefinitely into sharp, angular fragments. It is mined (as a fire-clay) mostly in Montgomery, Warren, Franklin, Crawford, Gasconade and Phelps counties, for shipment only, going to fire-brick works in St. Louis,

Chicago and Eastern cities, where it is used in connection with more plastic clays to diminish their shrinkage.

In one locality near Union, in Franklin county, the upper four or five feet of this clay is plastic. Another variety occurring in many places is white, brilliantly mottled with reddish tints, and sometimes stained very dark purple; is comparatively soft and free from sand; has a smooth, soapy feel and is cut with a knife in an extremely smooth, soft way.

These three phases, the hard fire-clay, the plastic clay, and the last-mentioned variety—called locally ‘kaolin’—may represent different horizons in this group of clays, and it is probable that the variety called ‘kaolin’ is part of the same formation which is found southeast of this region, where it has been considered a true kaolin, occurring in the place of its origin among the parent crystalline rocks.

The only trace of organic remains found in this group by the writer was taken from the clay pit of Isidor Mandle, in Regina, Jefferson county (where the clay is worked and shipped east to porcelain factories). This specimen consisted of a piece of beautifully carbonized wood, nearly two feet in length, and five inches by three inches, in cross section, at its larger end, whence it tapered towards the other end to about half that size. A piece of this wood was sent to Prof. F. H. Knowlton at the Smithsonian Institution, who prepared sections of it for microscopic examination and kindly furnished the writer with the following information in regard to it, which is given in his own words:

“The structure is very finely preserved and comes out beautifully. It belongs to the genus *Dadoxylon*, and is very close to *Dadoxylon Beinertianum* Endl., from the Sub-carboniferous Falkenburg in Silesia. The wood cells have one, or more often two, alternating rows bordered with oblong cells

or inner pores, those on the opposite sides being placed at right angles, thus producing a kind of maltese cross within each circle. This is very characteristic of the Palæozoic genus *Dadoxylon*, and your material cannot by any means have come from the Tertiary unless it has been redeposited. The specimen itself is Palæozoic, and the question of its possible removal from its original position is, of course, one of stratigraphy."

GEO. E. LADD.

ATLANTA, GA.

NOTE ON A BREATHING GAS WELL.

A VERY remarkable gas well recently came under the writer's observation while engaged in studying the geology of the Santa Lucia Range. It is situated on the Eagle Ranch, on the eastern side of the Range in San Luis Obispo county, California.

The well is interesting on account of two things: (1), the presence of gas in the Golden Gate series, it being encountered while boring for water; and (2), the intermittent flow of gas, the periods of flow alternating with those of drawing in air.

The geology of this portion of the range is quite complicated. In the vicinity of the Eagle Ranch there are four different formations; the oldest, the Golden Gate series, consisting of shale, sandstone and jasper, with numerous ancient eruptives, the whole being probably of Upper Jurassic age. The rocks of this series are extensively developed through the Coast Ranges of California, but have never before been found to contain gas, nor have any indications of coal or oil been met with.

The well was bored on the point of a hill rising perhaps seventy-feet above a little flat on which the ranch buildings are situated; this flat is underlaid by Lower Cretaceous shales which surround the hill on three sides. The Chico sandstone occurs, overlying the shales in various places;

while to the east, some distance away, the Bituminous Slate series (Miocene) is met with filling the Salinas Valley. The Miocene is preëminently the oil and gas bearing formation of California. The writer does not know of any locality in the State where gas is obtained in quantities sufficient for use from beds of Cretaceous age, although such may be the case.

The well under consideration has a bore of six inches and was put down to a depth of three hundred and fifty-six feet. The strata passed through consists of shale and sandstone having a very steep dip. They are exposed on the south side of the hill at a distance of a little more than a hundred feet from the well, and exhibit the intense distortion of and shearing so characteristic of the Golden Gate series. When first bored, the water rose to within about eighty-five feet of the surface. A small amount of gas was encountered at a depth of ninety feet. Comparatively little gas came from the well at first, but during a stormy spell the well was pumped continuously for some time, and as the water grew lower a noticeable amount of gas began to issue. This increased until it was estimated to amount to twenty thousand feet per day. This state of things lasted for about six weeks, when the volume began to decrease, finally becoming intermittent. The well has now been opened for four years, the gas continuing to average about 250 feet per day. During settled weather the intermittent action is fairly regular, the gas issuing for about three hours, when an equilibrium being reached, the current changes and air is sucked in for the same length of time. If the air is not allowed to enter the gas will not flow; consequently an automatic valve has been placed at the surface of the well, permitting the ingress of the air. The suction is frequently so strong that, if only a small opening is left a roaring sound is produced, which is audible at the ranch house.

The gas issues also with a strong pressure. The amount of water in the well does not affect the flow of gas in any manner.

Whatever the cause of the intermittent action it is influenced by the varying pressure of the air, for before a storm, when the barometer is falling, the gas continues to issue for a much longer period, sometimes for 24 hours; and when the rise in the barometer takes place there is the same prolongation of the period of inhalation. During high barometric conditions the equilibrium may continue for some time. The well at the present time produces four to five thousand gallons of water per month, being pumped on an average about every two weeks. The locality is about twelve miles from the sea in a direct line, and has an elevation of 1,300 feet, so that it would seem impossible that tidal action could have anything to do with the phenomenon. During a talk with Mr. Benton, the superintendent of the ranch, who has closely watched the well, he stated that he had noticed no connection between the respiration and any physical conditions save the one referred to. The gas is used in all the ranch buildings, but is of such a character that with the ordinary burner it does not give a good light, consequently an incandescent burner is used.

The question of the source of the gas is rather a puzzling one. It hardly seems possible that it can be derived from the strata penetrated, and if not it must have its source in the surrounding Cretaceous shales, or possibly in the white Miocene shales, which here, as nearly everywhere else, are filled with animal remains. A well was sunk to a depth of 900 feet in the same area of Cretaceous shales about two miles miles to the west, but without encountering water or gas. If derived from the Miocene shales the gas must circulate through the rock for nearly three-fourths of a mile at least. The water is very pure, containing

no alkali or trace of oil such as might be expected if it has passed through Miocene strata.

As to the cause of the intermittent action no reasonable explanation has occurred to the writer, and it is left for physicists to explain. It is certainly not due to any of the connections on the surface, for the facts stated were observed prior to such connections.

HAROLD W. FAIRBANKS.

BERKELEY, CALIFORNIA.

SOURCE OF X-RAYS.

NOTWITHSTANDING the considerable amount of attention the subject of Röntgen's discovery has received, there is a very wide diversity of opinion concerning the part of the vacuum tube at which they are produced. In view of the high reputation of the authorities who have expressed their decided opinions on this subject as experimenters and observers, it would be rash to advance the statements here made as being opposed to their own views. It is unquestionably true, however, that the evidence here given must be considered as demonstrating that *in this form of vacuum tube the X-rays radiate in all directions from the surface first encountered by the cathode rays*, and that they do not start from the anode.

Fig. 1 represents the vacuum tube. It is made of German glass tubing, 4 cm. in diameter and 8 cm. long. One end is drawn out, and an aluminum electrode terminating in a disc is inserted at A. A second is inserted in the side, at C, and is enclosed in a thick piece of glass tubing, to prevent any radiations from it reaching either A or B.

The end B has a flange which is ground to receive a ground plate of aluminum B. This plate is 3 mm. thick, except at the center, where it is ground away to a thickness of about one-tenth of a millimeter. The joint was made by melting shellac (containing a small quantity of rubber) around

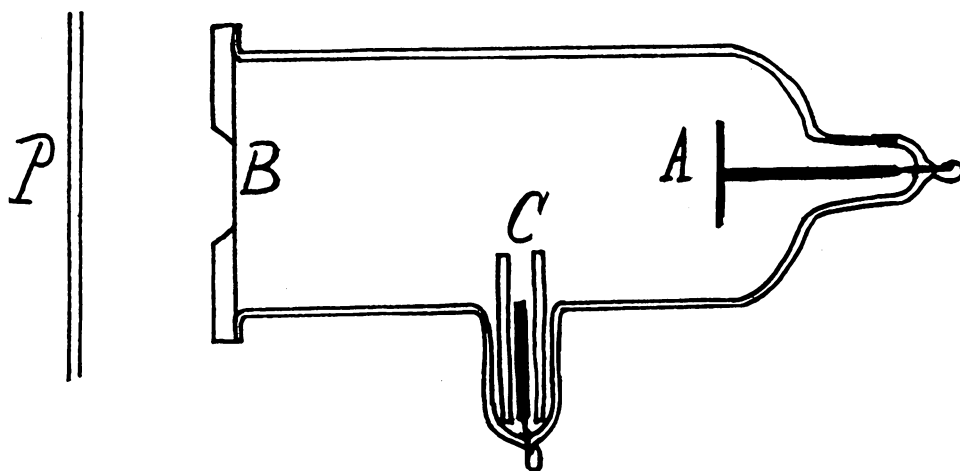


FIG. 1.

the outside. This joint was found to hold so well that the discharge frequently passed through the air (about 5 cm.) outside the tube.

A photographic plate in its plateholder was placed at P, about two centimeters from the aluminum plate B. The experiments were as follows :

1. A was made the cathode and B the anode. The resulting photograph is given in Fig. 2. It shows that the X-rays radiate in all directions from the thin portion of the B.

2. B was made the cathode and A the anode. The resulting photograph is given in Fig. 3. It shows that the X-rays radiate

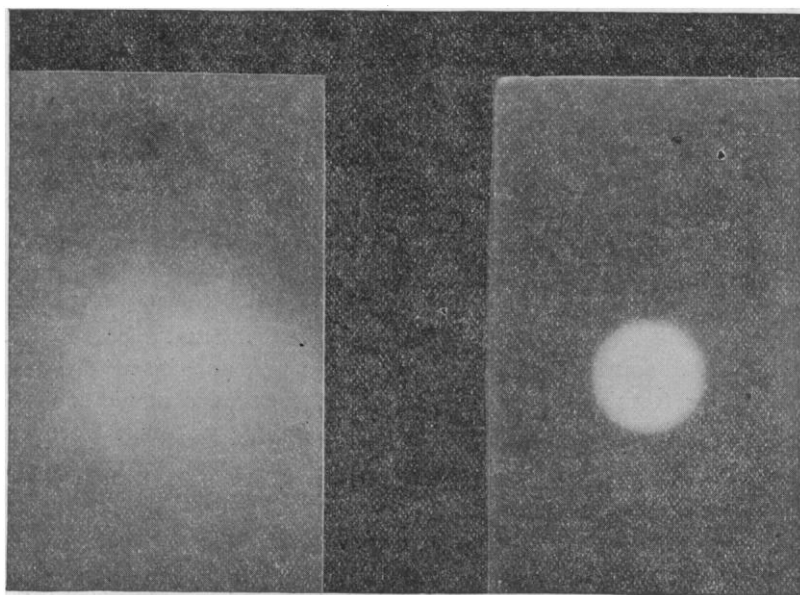


FIG. 2.

FIG. 3.

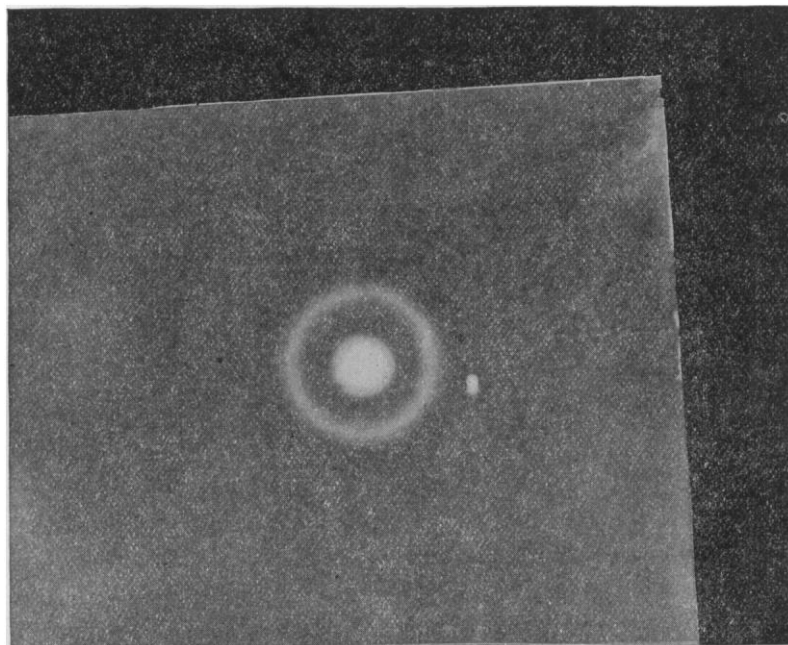


FIG. 4.

from A and cast a shadow, moderately well defined, of the plate B.

3. B was made the cathode and C the anode. An iron washer was placed in contact with the thin aluminum window at B. The resulting photograph is given in Fig. 4. It shows that the X-rays radiate from A exactly as in (2), casting a shadow of the aluminum disc and the iron washer in front of it.

Now, while it is possible to explain experiments (1) and (2) by considering that the X-rays radiate from the *anode*, no such explanation will account for experiment 3, in which the undoubted source (A) was unconnected with either terminal of the secondary coil which furnished the discharge.

On the other hand, not only are all three experiments consistent with the statement given above, but the origin of the X-rays at the place where fluorescence is excited on the glass walls of the common form of Crooks tube is also thereby accounted for.

While it may be true that the effects may be enhanced by making the anode the first object encountered by the cathode rays, the result of these experiments is to show that the anode does not play an important rôle in the phenomenon.

A. A. MICHELSON,
S. W. STRATTON.

CURRENT STUDIES IN EXPERIMENTAL GEOLOGY.

THE COLOR OF WATER, AS AFFECTED BY CONVECTIONAL CURRENTS.

PROF. W. SPRING, of Liège, has just added a new and interesting contribution* to our knowledge of the causes of illumination of deep waters. Pure water is actually blue when seen through sufficient thickness. Spring showed in 1883 that perfectly colorless particles in suspension would form a turbid medium, giving passage to

* Arch. des Sciences phys. et nat. Geneva, March, 1896.

the red and yellow rays, but reflecting the rays of shorter wave-length, *i. e.*, the blue and violet. Hence, light reaching the observer by *transmission* appears greenish, the original blue of the water being added to the transmitted orange rays. The blue of reflection is largely absorbed, or but slightly augments the color of the water. Blue water should contain no turbid elements, but deep water absolutely free from turbidity should absorb all rays and appear black. Contrary to this, the Mediterranean and the Lake of Geneva in their deeper portions are intensely blue. Hence, even the most limpid waters are not optically void. Tyndall and Soret believed that even the purest water might contain particles in suspension which account for the *illumination* of the blue waters in nature. This is contradicted by the evidence from experiments with polarized light, and by the fact of the absorption of the rays of minimum wave-length by a turbid medium.

As a further test, however, Prof. Spring has prepared an elaborate apparatus to prove whether loss of illumination by absorption through a great thickness of water be accompanied by a loss of *transparency* due to the presence of particles in suspension, as in the case of the atmosphere. A tube of glass was constructed, 26 meters long and of 15 mm. internal diameter, mounted at a slight inclination on a scaffold and straightened with hand vises until its axis coincided with the optical axis of a telescope adjusted at one end. Heavy black paper covered the tube throughout its length, and the ends were sealed with glass plates, the one nearer to the source of light bearing 'cross-hairs.' Glass tubes were fitted at each end for the introduction of the water, which was distilled with the utmost care in platinum retorts. Either daylight or the Auer incandescent burner could be used as illuminants.

A column of water 26 m. long appeared

deep blue; with the illumination of the Auer lamp, the telescope revealed the cross-hairs *as sharply defined* as though the tube were empty; hence the presence of foreign particles is improbable. Small apertures pierced in the paper wall of the tube gave evidence of emission of light laterally only at a distance of 2 meters from the lamp. This suggested some influence of the heat rays; to test this, water 12° C. warmer than the tube was introduced and produced complete opacity, which gradually passed off as the water regained the normal temperature. The minimum difference of mean temperature which would produce opacity was determined to be only 0.57° C.

A shorter tube 6 m. long was constructed of metal with a view to testing the local application of heat. On applying a flame at one point in the side of the tube, the sharply defined opening at the farther end appeared to enlarge, became blurred and finally disappeared, leaving an evenly illumined field. The effect suggested a cloud passing before the sun. Continued application of heat produced complete darkness.

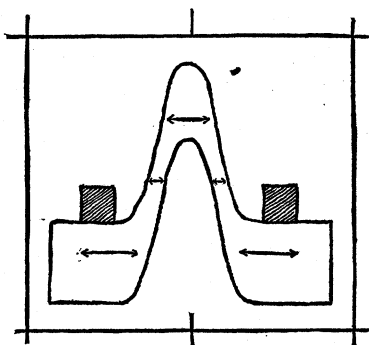
These experiments show that bodies of water are not optically homogeneous when traversed by convectional currents, even though the latter are caused by very slight differences in temperature: the warmer portions have the properties of a turbid medium. Hence less absorption and greater emission of light, making apparent the blue color of the water. Cooling increases transparency, hence the differences of color produced by the cooling shadow on the water's surface, of a cloud or a mountain; a dry wind, cooling the water's surface by increased evaporation, will at the same time increase its transparency. Conformable to this explanation is the fact stated by Forel, that fresh water lakes are more transparent in winter than in summer. The facts described are not held by the author to preclude the operation of other agencies, for

doubtless the illumination and color of water are frequently due to combined causes.

THE PLASTICITY OF ICE CRYSTALS.

DR. O. MÜGGE has recently published the account* of a series of experiments on the deformation of ice relative to its crystalline structure. McConnel's experiments have shown that permanent deformation by *bending* may be induced in an ice slab only when the pressure acts in the direction of the optic axis; the optic axis remains normal to the curved basal surface after bending.

Mügge shows that plastic translation without bending is possible only in a plane perpendicular to the optic axis. To the middle of a small bar of ice placed across two supports, the latter as near together as possible, a heavy weight was attached by a strap. The optic axis lay horizontal. A portion of the ice, about as wide as the strap, was gradually drawn down until completely detached. (See figure.) The temperature remained below freezing. The stretched portions were optically oriented exactly like the main bar, the axis lying everywhere horizontal as indicated by the arrows.



The plane of the base was determined to be the only plane in which such translation could be induced; pressure oblique to a basal slab was found to produce torsion

*Neues Jahrbuch für Min., Geol. und Pal., 1895, Bd. II., Heft 3, p. 212.

that tended to bring the optic axis into coincidence with the direction of pressure.

These experiments prove that plastic deformation and flexibility are important components of the movement of glaciers. The parallel position of the optic axes of associated 'Körner,' or glacial granules, has been observed, at least locally; this is undoubtedly due to the fact that by translation on planes parallel to the base and simultaneous bending, the optic axis is forced into parallelism with the direction of pressure. Observations on plates of ice cut from the Aletsch Glacier show that where its bed sharply slopes, the optic axis lies at right angles to the lower surface of the ice. It is probable also that the increased purity of the ice at a glacier's lower extremity is due to the gradual liberation of 'air bubbles' in migration along definite planes.

T. A. JAGGAR, JR.

CAMBRIDGE, MASS.

NOTES UPON AGRICULTURE AND HORTICULTURE.

THE POTATO SCAB.

SEVERAL Experiment Stations are making tests of various remedies for the potato scab. This trouble of the potato is due to a fungus closely related to the bacteria.

Bulletin No. 33 of the Rhode Island Station gives a somewhat lengthy report of experiments that cover three years with various chemicals. Dr. Wheeler and Mr. Tucker, the authors, state that air slaked lime, wood ashes and calcium carbonate, calcium acetate and oxalate all increase the scab; while calcium chloride prevents it, but likewise injures the potato plant. Calcium sulphate (land plaster) is the only form of lime not harmful to the potato which fails to increase the scab. Common salt reduces the amount of scab, and this explains why sea weed is healthful to potato land when used for manure. Barnyard

manure increases the scab, probably because alkaline. On the other hand, oxalic acid tends to reduce the scab. It is thought that anything which reduces the acidity of the soil will increase the scab. The scab fungus seems to multiply in the soil when the potato crop is not present. Upon acid soils practical immunity from scab has been secured for three years. Upon acid land potatoes free from scab may be grown if no barnyard manure is used.

CHERRIES.

UNDER the above short title Prof. Bailey and Mr. Powell have prepared a bulletin (No. 98 Cornell University Experiment Station), giving among other things the classification of cherries under the horticultural groups; namely sours, amarells and morellos, sweets, mazzards, hearts, begarreaus and dukes, and then the botanical grouping. There are two species, namely, *Prunus cerasus* L., the sour cherries, and *P. avium* L., the sweet cherries, with three well-marked varieties under the latter species.

Cherry growing is a neglected industry. The tree likes a rich loamy soil with frequent cultivation. The worst enemy is the curculio, and jarring the trees will save many cherries. For the rot spraying with Bordeaux is recommended. The bulletin is illustrated with several engravings of fruits made from photographs of subjects natural size.

CURRENTS.

NEW YORK STATE can boast of two Experiment Stations, one, the older, at Geneva, and the other at Ithaca. Both have their number of issues in the nineties, while, for example, No. 98 of the Cornell University Station is upon cherries, briefly mentioned in the previous paragraph, the No. 95 of the New York Station deals with currants. Prof. Beach, in this, informs the readers that the testing of varieties of currants began at Geneva in 1882 with eleven sorts.

Now there are forty under study and this exclusive of seedlings. It is shown that of the red sorts the Prince Albert is the largest bearer, it averaging nearly nine pounds per plant. The White Dutch is the most productive of the white sorts. But it seems from the bulletin that quantity is not everything, for healthfulness of bush, shipping quality and flavor of the berry must all be considered. One sort may be too watery for profitable jelly making or have a skin too thick for jam, etc. The reader of these bulletins upon fruits is led to imagine that the stationists practice all the phases of the culinary art in order to pass judgment upon their subjects.

BYRON D. HALSTED.

NEW BRUNSWICK, N. J.

CURRENT NOTES ON ANTHROPOLOGY.

SOUTH AMERICAN LINGUISTICS.

DR. RODOLFO LENZ continues his valuable contributions to the study of the Araucanian stock by the publication of a series of dialogues in the Picunche dialect. His presentation and analysis are fully up to the requirements of modern scientific linguistics. His article appears in the 91st volume of the 'Anales de la Universidad de Chile.'

The tireless student of the Argentinian languages, Samuel A. Lafone Quevedo, publishes in the 16th volume of the 'Boletin del Instituto Geographico Argentino' an essay of over forty pages on the Vilela or Chulupi language of the Chaco. His material is mainly from the works of Hervas, Adelung and Pelleschi. The results he reaches confirm the statement of affinities between the Lule and Vilela tongues which I advanced in my 'American Race,' p. 313 (1891). That these related dialects should be classed with the Pacific or Andean tongues on account of their suffix formations and personal pronouns, is not yet sufficiently demonstrated.

The journal 'Languages' (published in London) stated in June last that the British consul in Bolivia had discovered some hitherto unknown native idioms in that country; but no further information about them has appeared.

THE DIMINUTION OF NATALITY.

THIS subject occupied a prominent place in the discussion of the anthropological section of the French Association for the Advancement of Science at its last meeting. More than elsewhere, it deserves attention from the scientists of that nation, for out of the 86 departments into which France is divided, in 51 the deaths exceed the births. The annual natality for the whole country is only 23.7 for each 1,000 inhabitants, and this number includes the still-born!

To remedy this progressive depopulation, its causes must be ascertained. Dr. E. Maurel brought forward an interesting theory. He pointed out that the birth rate is lowest in those departments where food is most abundant and cheapest. The relation between these two facts he held to be the prevalence of hereditary arthritic diathesis (uric acid diathesis), leading to diminution of reproductive vigor in both sexes, this diathesis arising from excessive alimentation. Another speaker, Dr. Pommerol, attributed the diminished natality to voluntary restriction, while others suggested the increase of religious celibacy, the laws relating to the division of property, the lateness of marriages, and the decreased reproductiveness of women.

D. G. BRINTON.

UNIVERSITY OF PENNSYLVANIA.

SCIENTIFIC NOTES AND NEWS.

VIVISECTION IN THE DISTRICT OF COLUMBIA.

DURING the recent session of the National Academy of Sciences a report was prepared with reference to the proposed legislation interfering with the practice of vivisection in the District of Columbia. The report states that

physiology must be studied by experimental methods. The physiologist, no less than the physicist and the chemist, can expect the advancement of his science only as the result of carefully planned laboratory work. If this work is interfered with medical science will continue to advance by means of experiment, for no legislation can affect the position of physiology as an experimental science. But there will be this important difference: The experimenters will be medical practitioners and the victims human beings. That animals must suffer and die for the benefit of mankind is a law of nature, from which we cannot escape if we would. But the suffering incidental to biological investigations is trifling in amount and far less than that which is associated with most other uses which man makes of the lower animals for purposes of business or pleasure. The men engaged in the study of physiology are actuated by motives no less humane than those which guide the persons who desire to restrict their action, while of the value of any given experiment and the amount of suffering which it involves they are, owing to their special training, much better able to judge. When the men to whom the government has intrusted the care of its higher institutions of research shall show themselves incapable of administering them in the interest of science and humanity, then, and not till then, will it be necessary to invoke the authority of the national legislature.

RADIATION FROM URANIUM SALTS.

IN an important article in *Nature* (Apr. 23), Prof. J. J. Thomson states that the investigations of M. Henri Becquerel on the radiation emitted by certain salts of uranium have shown the existence of a kind of radiation intermediate in its properties between light and the Röntgen rays. These investigations are exceedingly interesting on account of the differences as well as the analogies they disclose between the uranium radiation and the Röntgen rays. M. Becquerel has shown that the radiation from the double sulphate of uranyle and potassium is analogous to Röntgen rays, inasmuch as it can affect a photographic plate after penetrating substances such as aluminium, copper, wood, etc., which are opaque to ordinary light; it also resembles

these rays in being able to discharge an electrified body, whether the charge be positive or negative. On the other hand, it differs from Röntgen rays and resembles ordinary light, inasmuch as it can be refracted and polarized. It is also much more easily reflected than Röntgen rays. The radiation from the uranium salts is thus intermediate in properties between ordinary light and Röntgen rays; and as there can be no question but that this radiation consists of transverse vibrations, inasmuch as it can be polarized, it affords strong presumptive evidence that the Röntgen rays are also due to transverse vibrations.

The persistence of the radiation from the potassium uranyl sulphate is very remarkable. M. Becquerel found that crystals which had been kept in the dark for 160 hours continued to radiate vigorously. This radiation is absorbed almost equally by aluminium and copper, so that it does not show the same dependence upon the atomic weight of the absorbing medium as that of the Röntgen rays; on the other hand, the radiation resembles Röntgen rays in not being homogeneous.

GENERAL.

THE Council of the American Association for the Advancement of Science at the Springfield meeting instructed the sectional committees hereafter to prepare a programme for their sectional meetings and transmit the same to the Permanent Secretary at least one month before the annual meeting. The Buffalo meeting opens on Monday, August 24th, and titles and abstracts of papers should be sent by members to the Secretaries of the sections at as early a date as is convenient.

THE German Society of Naturalists and Physicians will meet at Frankfort-on-Main from the twenty-first to the twenty-sixth of September.

WITH the last issue of the Proceedings of the Royal Society an index slip is issued giving the details needed for an author and subject catalogue of the contents. In the case of one paper there are as many as eleven entries for the subject catalogue. The index slip is printed on one side of thin paper so that the entries can be conveniently attached to cards.

The Physical Review for May-June will contain articles on 'Solids and Vapors,' by Wilder D. Bancroft; 'On the Heat Effect of Mixing Liquids,' by C. E. Linebarger; 'The Influence of Heat, of the Electric Current, and of Magnetism upon Young's Modulus,' by Mary Chilton Noyes, and 'A Photographic Study of Arc Spectra,' by Caroline W. Baldwin.

THE prize founded by M. and Mme. Victor Saint Paul for the discovery of a remedy for diphtheria will be divided by the French Academy of Medicine and has been divided between Dr. Roux and Prof. Behring.

It is unofficially announced that the local committee in charge of the International Medical Congress to be held at Moscow this year has reversed its decision to exclude English from the languages to be used.

LONGMANS, GREEN & CO. have issued a reprint of Tyndall's *Glaciers of the Alps*.

THE Metric System is being actively discussed by correspondents in the *London Times*. Those opposing the Metric System seem to be in the majority, but the arguments used seem to be mostly trivial or absurd.

GOV. MORTON has nominated Charles A. Weitling, of Cobleskill, N. Y., to succeed Frederick C. Schraub as New York State Commissioner of Agriculture.

PROF. H. LANDES, of the State University of Washington, has been appointed State Geologist.

THE semi-annual meeting of the American Antiquarian Society was held in Boston on April 29th. Among the papers presented was one by Rev. Stephen D. Peet on the history of archæological explorations in the Mississippi Valley. Prof. J. W. White, of Harvard University, was elected President.

It is reported in the *British Medical Journal* that those working with the X-rays are likely to suffer from a variety of skin affections said to be similar to the results of sunburn.

THE *London Times* states that a recent sale of birds' eggs included a specimen of the egg of the great auk (*alca impennis*). This specimen, except for a small fracture on one side, is in good preservation. It was purchased in 1841 from Mr. Hugh Reid, of Doncaster, who bought

it in the same year from Frederich Schutz, of Dresden, and has now been sold by order of the executors of the late Mr. James Hack Tuke, of Hitchin, and was sold for 160 guineas. It may be interesting to point out that six or seven years ago there were only 68 specimens of the egg recorded. The highest price of £300 was paid for a duplicate for the collection of Baron d'Hamonville, of Meurthe, France, two years ago. Shortly after this event two very good specimens were detected among a collection of eggs purchased at a sale in the country for 30s., and were subsequently sold by Mr. Stevens last year for 275 guineas and 185 guineas respectively. A third specimen, Sir. W. Milner's, came into the auction room during last season and fetched 180 guineas. A few years ago a number of exceedingly clever forgeries of the egg were manufactured. Two other interesting eggs were sold immediately after the above mentioned great auk's egg—a very fine specimen, slightly cracked, but otherwise in first-rate condition, of an egg of *xyornis maximus* realized 40 guineas; and the only example of an egg of *xyornis grandidieri* ever offered for sale in this country sold for 35 guineas.

THE New York State Fish, Game and Forest Commission recommends that an amendment be made to the State Constitution giving the commission power to lease at a nominal price small tracts of the Adirondack preserve to citizens of the State for the erection of cottages or camps. The Commission states that New York owns about 1,000,000 acres of land in the counties constituting the forest preserve (the greatest park in the world), all of which is practically within the Adirondack park. These campers or cottagers would make the very best guardians of the forest, as they would at all times be oresters, game protectors and fire wardens.

THE death is announced of Prof. Anatoly Petrovich Bogdanoff in Moscow. *Nature* states that he was born in southern Russia in 1834, and after studying at the Moscow University, and writing, in 1858, his first dissertation on the colors of birds, he became professor of the same University in the year 1863. In connection with this work he wrote an excellent text book of zoölogy, and a still better work, unique in its kind, namely, a *Chrestomathy of Zoölogy*,

in three volumes, in which the reader obtains a thorough scientific acquaintance with the different classes of the animal kingdom by means of admirably chosen abstracts from the best authors, considerable attention being given to purely biological questions, and especially to the lowest animals, as well as to their manners of life. In the sixties, Bogdanoff founded, at Moscow, the well-known 'Society of Lovers of Natural Sciences, Anthropology and Ethnography,' whose numerous quarto volumes of *Memoirs* rank among the best scientific publications in Russia, and whose expeditions included the well-known Turkestan expedition of the late Fedchenko and Madame Olga Fedchenko. The chief anthropological work of A. P. Bogdanoff was on the inhabitants of the grave-mounds of the Moscow region. The full list of his nearly forty anthropological, and nearly thirty zoölogical works is given in 'Materials for the History of Zoölogy, pure and applied,' in Russia, chiefly for the last Thirty Years,' of which he was the editor, and of which three volumes have already been published. His works for popularizing biology, especially on Darwin's ideas, and for extending the interest in anthropology, are also numerous.

MACMILLAN & Co. have made arrangements for the issue in New York and London of a *Dictionary of Philosophy and Psychology* under the editorial supervision of Prof. Baldwin, of Princeton University. The work will contain concise definitions, such historical matter as may be necessary to justify the definition given and to show that the usage suggested is the outcome of the progress of philosophy, and full bibliographies. The following contributors are already announced: *General Philosophy and Metaphysics*, Prof. Andrew Seth, Edinburgh; Prof. John Dewey, Chicago. *History of Philosophy*, Prof. Josiah Royce, Harvard. *Logic*, Prof. R. Adamson, Glasgow. *Ethics*, Prof. W. R. Sorley, Aberdeen. *Psychology*, Prof. J. McK. Cattell, Columbia; G. F. Stout, W. E. Johnson, Cambridge; Prof. E. B. Titchener, Cornell; The Editor, Princeton. *Mental Pathology and Anthropology*, Prof. Joseph Jastrow, Wisconsin. *Biology*, Prof. C. Lloyd Morgan, Bristol. *Bibliography*, Dr. Benjamin Rand, Harvard.

WE learn from the London *Times* that the resolution of the Government of India on the annual report of the Geological Survey for the past official year mentions that, although survey work was continued in Rewah, the Central Provinces, and Beluchistan, the amount of work of this kind done was much less than usual, owing to officers being withdrawn for inquiries on economic subjects. The Rewah survey has led to some modification of the views hitherto held in regard to the Vindhyan system, the chief point established being the separation of the lower from the upper Vindhyan. On the northwestern frontier the survey extended to the range between the Luni plain and the Zhob country to the Tochi valley and to the country lying between Dera Ghazi Khan and Zarat. The publications of the Survey during the year include a fresh volume of the 'Palæontologica Indica,' dealing with the fossils from the ceratite beds on the lower trias of the Salt Range, and part of a volume on Himalayan fossils descriptive of the Cephalopoda of the Muschelkalk. This is said to be the first and a very important instalment of the special monographs now being prepared in Europe, for which a special grant has been made by the Government of India. Certain miocene fossils of upper Burma were also treated in a publication of the Survey. As to the economic side of the work of the department, the oil-boring operations at Sukkur were continued without success; in Burma Dr. Noeting brought to a close his inquiries into the occurrence and nature of earth oil; and in various other districts mineralogical surveys have been made, and existing gold and coal mines in Mysore, the Central Provinces and Hyderabad have been visited, while proposals for the regulation of the working of mines in India have been drawn up.

JAMES MERCUR, assistant professor of natural and experimental philosophy at West Point Military Academy, died on April 22d, at West Point. He had been assistant engineer on the survey of the northern lakes and assistant engineer in the removal of Hallet's Point and Flood Rock, Hell Gate, and had charge of various other engineering works.

WE have received from *The Engineering and*

Mining Journal advance sheets of Volume IV. of *The Mineral Industry*, giving statistics for the year 1895, from which it appears that the United States last year took the first rank as a producer, not only of the precious metals, but also of the most important of the useful metals, iron and copper, while in coal it is second only to Great Britain. The production of iron in 1895, as compared with that of 1894, showed the remarkable increase of 42 per cent. Steel showed an increase of over 10 per cent. and copper nearly an equal increase. Coal shows an increase of ten per cent. Silver is the only important product showing a decrease.

THE London *Times* states that important alterations are in progress in the Natural History Museum. Many of the less important specimens have been removed to store rooms, leaving space free in the exhibition galleries. The marsupials have been entirely rearranged and maps have been prepared showing their geographical distribution. A gallery in the western corridor has been set aside for the antelopes, and the unrivalled series of British birds has been removed to the ground floor. Space has been found for the birds through the rearrangement of the reptile gallery. Other changes are also in contemplation, as, for instance, in the first gallery, where the larger fishes are now seen suspended from the roof, so as not to cumber valuable floor space; while on the geological side there are signs of the approaching abolition of the hard-and-fast division which has so long separated paleontology from zoölogy and botany. Thus there may now be seen in the gallery of fossil mammalia skeletons of the Indian elephant, Indian rhinoceros and musk ox, placed for comparison with the fossil forms. 1,225 separate gifts, many of them comprising a large number of specimens, such as the Seebohm bequest, were received by the Museum last year.

In his address, as President, before the Lincoln Microscope Club, Prof. Bessey stated, according to the *Microscopical Journal*, that microscopes are extensively used in the public schools of Nebraska, most of the high schools owning at least six.

Popular Astronomy states that at the last ses-

sion of the Illinois Legislature an appropriation was made for the erection and equipment of an Observatory for the State University at Champaign. The designs for the building were made, under direction of Prof. Ira O. Baker, by the Architectural Department of the University. The instrumental equipment, consisting of a 12-inch equatorial, a 3-inch combined transit and zenith telescope and a chronograph, will be made by Warner & Swasey, the optical parts being made by Brashear. This makes four universities which have established observatories within the past year, all of which have ordered telescopes from Warner & Swasey, with optical parts by Brashear. The list is as follows: University of Pennsylvania, Philadelphia (18-inch aperture); University of Ohio, Columbus (12-inch aperture); University of Minnesota, Minneapolis (10½-inch aperture); University of Illinois, Champaign (12-inch aperture).

A CATALOGUE of the types and figured specimens of fossil animals in the United States National Museum has been recently completed, and comprises type material representing 3,644 species, distributed as follows: Invertebrates, Palæozoic, 1,155; Mesozoic, 1,024; Cenozoic, 1,312; Vertebrates, 163. The fossil plants are not yet fully catalogued, but it is known that they represent more than 2,000 species, over 500 of them being contained in the 'Lacoe Collection' alone. There are in round numbers 500 Palæozoic, and 1,500 Mesozoic and Cenozoic species. Every type or figured specimen is made conspicuous by attaching to it a small, green, diamond-shaped ticket, or a white ticket bearing the word type. Should any specimen be separated from its label this ticket will draw attention to the fact that the specimen is a type and must be cared for.

UNIVERSITY AND EDUCATIONAL NEWS.

JOHNS HOPKINS UNIVERSITY has published on the occasion of its twentieth anniversary statements concerning the university which bear witness to the important part it has taken in the advancement of higher education and research in America. The University has conferred 358 degrees of Doctor of Philosophy, and of these graduates 175 hold college professor-

ships. Eight hundred students of the University have engaged in teaching, and nearly every university and college in America numbers among its faculty a student of Johns Hopkins University. The following institutions have had in their faculties ten or more of its students: Chicago, 23; Wisconsin, 19; Bryn Mawr, 18; Stanford, 17; Michigan, 17; Pennsylvania, 16; Cornell, 14; Columbia, 13; Massachusetts Institute of Technology, 11; Nebraska, 11; Northwestern, 11; Harvard, 10; Woman's College of Baltimore, 10. There are now in the University 403 graduate students of which 150 are candidates for the degree of M. D. or physicians attending special courses.

THE catalogue of the University of Minnesota for 1895-96 shows the following enrollment for the year:

Graduate Students, all departments,	137
Undergraduates:	
College Science, Literature and Arts,	822
College Engineering, Metallurgy and the Mechanic Arts,	192
College of Agriculture:	
Collegiate Course in Agriculture,	10
School of Agriculture,	223
School of Dairying,	97
School for Women,	46
College of Law,	369
Department of Medicine:	
College of Medicine and Surgery,	243
College Homœopathic Medicine and Sur- gery,	31
College of Dentistry,	90
College of Pharmacy,	33
Summer School,	234
	2527
Students enrolled in more than one de- partment,	38
Total,	2489

THE Massachusetts Institute of Technology has issued a circular calling attention to the opportunities it offers to college graduates. There are this year 80 such students in the Institute, 69 of whom are from other institutions. The summer courses offered by the Institute are especially planned for advanced students.

AT the celebration of Founder's Day of New

York University on April 22d the corner stone of the first residence hall was laid. The building, which will be ready for use in September, will contain, in addition to rooms for 112 students, a music room, editorial rooms for the college periodicals, etc.

PROF. GEORGE S. FULLERTON, Vice-Provost of the University of Pennsylvania and Dean of the College, will retire from the latter office and will be succeeded by Prof. W. A. Lamber-ton, who in turn will be succeeded in the deanship of the School of Philosophy by Prof. W. R. Newbold.

DR. ERNEST B. SANGREE, of Philadelphia, has been elected professor of pathology and bacteriology in the Vanderbilt University, Nashville, Tenn.

DISCUSSION AND CORRESPONDENCE.

ON ROOD'S DEMONSTRATION OF THE REGULAR OR SPECULAR REFLECTION OF THE RÖNTGEN RAYS BY A PLATINUM MIRROR.

ON March 27th Prof. Rood published in this JOURNAL a short account of certain experiments which he claimed 'pointed strongly to the conclusion that in the act of reflection from a metallic surface the Röntgen Rays behaved like ordinary light.' If this sentence means anything, it means that the X-rays underwent regular or specular reflection. On April 10th, however, Dr. M. I. Pupin published in this JOURNAL an article in which he says, "If I understand Prof. Rood's words correctly, no claim is made by him of a discovery of regular or specular reflection;" and he then quotes from Rood the sentence given above. The remainder of Dr. Pupin's article is largely devoted to showing that with the methods employed by him no regular or specular reflection could be observed. This last conclusion we are ready to accept. Prof. Rood's experiments, however, were conducted in an entirely different manner, as follows:

Before reaching the sensitive plate the X-rays were obliged to traverse two aluminium plates, each having a thickness of .17mm., and behind them was a drawslide that had proved to be impervious to the sun's light falling on it during two hours. Over these shields was placed

a wire netting with openings of $\frac{1}{8}$ inch. The reflecting surface was a large piece of bright platinum foil, seven inches square. This last was necessarily so arranged that a diffused reflection from it would have reached all parts of the sensitive plate. In point of fact, however, an image of the wire netting was obtained only on a strip of the plate, viz., on that portion that would be reached by the Röntgen rays in case of their regular or specular reflection.

The proof that the image of the wire netting on the sensitive plate was really produced by the *specular reflection* of the X-rays from the platinum was obtained in the following manner. The plate which had received the image of the netting made by the X-rays was removed from the plateholder and replaced by a fresh plate; this plate was not screened at all, but its sensitive surface was freely exposed in the dark at night.

Everything else in the arrangement of the experiment, including the position of the netting in front of the plate, remained as it was during the experiment with the X-rays. One flash from the inductorium was sent into the Crookes tube and the experiment was ended. On developing the plate it was found that *the light* from the Crookes tube had exactly reproduced in a fraction of a second what had required ten hours of action of the X-rays. There was the same portion of the plate acted on by the light as had been acted on by the X-rays, and the image of the netting given by the X-rays was reproduced by the light, not generally reproduced but minutely so; all the deformations of the image of the netting resulting from the reflection from the uneven surface of the platinum foil were alike in the photograph obtained by the X-rays and in the photograph obtained by the light.

I paid repeated visits to Rood's laboratory during the progress of these experiments, and after a careful examination of his negatives no doubt remained in my mind of the fact that he had demonstrated the regular or specular reflection of the Röntgen rays.

Prof. Rood carried these and other similar negatives to Washington, where he read a paper on the reflection of the X-rays before the National Academy of Science on April 23d.

The original negatives were carefully examined by the physicists present, Prof. Rowland devoting half an hour to their critical examination; and I do not think that the slightest doubt was held, by any of the six physicists present, of the completeness of the demonstration.

I cannot conceive how Dr. Pupin, after an examination of Rood's photographs, could differ from, deny, or even doubt, the conclusions reached by several of the most critical and experienced physicists of the country after their examination of these photographs.

ALFRED M. MAYER.

PSEUDO-SCIENCE IN METEOROLOGY.

IN the issue of SCIENCE for April 10th nearly a full dozen columns of valuable space have been devoted (under a rather misleading title) to recording observations and opinions which are to prove the absence of a favorable influence of forest cover on meteorological phenomena and especially on waterflow in the Western Mountains.

Since this subject has become not only one of considerable scientific interest, but also of great national importance, far-reaching economic policies depending in part on the answer which science or well sustained observation and argument can give to the question, it may not be out of place to devote further space to the question in order to warn against the many erroneous observations and fallacious conclusions contained in the article referred to.

I do not wish to offend the writer when I say that by neglecting to sift more carefully the untutored and too-often-prejudiced opinions and notions of so-called 'practical' men at the hand of the *established* facts of science, physical, physiological and meteorological, he has done harm; for he has not only increased the accumulations of 'practical' or pseudo-science, to which to be sure, many so-called 'scientists' contribute no small share, but he has also discredited the sometimes valuable—when used with discretion—observations of laymen with those men of science who read with a knowledge of the laws of physics and the facts of meteorology before them.

Sure enough meteorology, especially on the

side of accurate measurements, is but poorly developed; nevertheless there is much more real knowledge in existence regarding many of the physical processes and conditions involved, not only qualitatively, but even quantitatively (as, for instance, regarding the behavior of snows, the evaporation of water, the transpiring of trees, and the conditions which influence these and the run-off and waterflow of rivers) than the writer of the article is aware of, so that it is not necessary to rely on *opinions* of 'practical' observers for these details at least.

I wish, however, not to be understood as discrediting in any way field observations and argument from them and as insisting upon accurate measurements as the only basis for the explanation of natural phenomena. On the contrary, I am one of those who believe that many complicated natural phenomena withdraw themselves for the present, *i. e.*, with our present knowledge and means, from accurate measurement; being results of complex and variable conditions which we are not prepared to measure, we may only by careful, long continued field observation and upon sound argument from well-known physical laws come to conclusions and determine relations qualitatively, leaving quantitative measure of these relations to be worked out in the future with improved method.

The present question, namely, that of forest influences on meteorological phenomena, is one of these, for in the first place we have as yet neither instruments nor methods to measure with any determinable degree of accuracy the rainfall over a given area, much less the evaporation; and even riverflow is not yet satisfactorily measured. And when it comes to the many varying influences affecting these phenomena quantitatively, we are entirely debarred from speaking with assurance even as to methods of determining them.

It would require too much space to discuss in detail the many erroneous statements and conclusions contained in the article referred to and which any meteorologist or physicist can readily discover. I shall have to confine myself to pointing out the fallacy of the main argument, which appears the more important as it has been advanced before by others with a flavor

of authority. This argument is, if I understand it correctly, that in the Western mountains the riverflow is dependent on the accumulation of winter snows; that on the open ground these snows are drifted, accumulated and packed together, whereby the melting of the snow is retarded and the supply of available water prolonged; that in forests the snow melts sooner, because lying less thick; that various other causes, like mechanical obstruction to the snow in reaching the ground, transpiration, greater evaporation under trees, etc., reduce the available water supplies and hence that forests as far as waterflow is concerned are an evil. This deleterious effect, by the way, is argued almost in the same breath with which the statement is made that the forest growth in these mountains is so open, casts so little shade, accumulates so small amount of litter and offers so little obstruction to sun and wind that its effect in shading and protecting the soil and reducing evaporation may be set down as *nil*.

Now it is true that the rivers of the Sierra rely for their supply mainly on the snow waters, hence any conditions which preserve and lengthen this supply, will influence the quantity and continuity of the river flow. If, therefore, the snow drifts melt more slowly and at the same time give as much available water in proportion to the amount of snow fallen, this would be an advantage. The slow melting is true, however, only for high altitudes above timber line, which represent a comparatively small area; below timber line the snow drifts are all gone long before midsummer, and it is only with such as lie at similar altitudes, and hence under similar temperature and wind conditions, that the condition of the snow under forest cover may be compared; here even this seeming advantage of the snow drift, the slower melting, will be found not as great.

But the very length of time during which these snow masses are exposed to the other dissipating influences, especially the 'dry air of the mountains,' on which the writer dwells with particular emphasis, is detrimental to the amount which becomes available to the soil. It is, therefore, by no means certain whether the quantity of water delivered to the soil is in any relation to the time during which it is delivered.

Knowing from tolerably reliable measurements the enormous evaporative power of air, especially when in motion, with high velocities of wind such as are common in high altitudes, we have good reason to doubt this, although undoubtedly the drifting, and hence reduction of exposed surface, reduces this loss somewhat.

It would appear much more desirable to have the snows melt quickly, provided their waters have time and opportunity to sink into the soil and away from the dissipating influences of dry air and wind, which are bound to rob the exposed drifts and leave less water for the soil. And here we reach the most important lack in the writer's argument and the most important claim of those who argue an influence of forest cover on waterflow, namely, as to the manner in which the rivers receive their water.

Even if we grant, for argument's sake, the unsubstantiated assertions of the writer, that the forest cover on these mountains is too sparse to exert any but deleterious influences with regard to conservation of snows, a contradiction in itself, he overlooks the most potent effect, which even the stumps as well as all shrubs and young growth have on the penetrability of the soil for the water.

He overlooks, as most writers on the subject do, the fact that it is not so much the surface drainage which reaches the rivers that forms the desirable supply, as the subterranean or ground waters. Surface drainage means rapid flow, high water stages, alternating with low water, uneven distribution through the year. Subdrainage means less excessive water stages, more even, steady and persistent flow, for the ground water reaches the river sometimes only *several years* after it first sank into the soil, and hence equalizes the effects of dry and wet seasons while the surface waters are carried off at once and are responsible for floods, followed by low water. Anything, therefore, that tends to change surface drainage into subdrainage is to be encouraged.

If there were, therefore, no other means by which a forest cover acted as a preserver of water supplies, the mere existence of the root system, penetrating the soil in all directions and facilitating percolation of the water, would be beneficial.

In this way, if the observation that after the removal of the old timber in Nevada the water-flow was more even be correct (which I hesitate to accept), it would find explanation in this, that the stumps and roots decayed and thereby increased the channels for the percolation of surface waters.

In conclusion I would say, that geological structure and soil conditions may be such, that percolation takes place readily even without the additional aid of a forest growth, when the effect of the latter may become irrelevant, although as a rule it may be accepted as a result of forest removal and exposure of soils, when new growth is at the same time prevented by fires and by sheep herding, that all soils become gradually more compact and less penetrable; that then more water goes over the surface and less remains for subdrainage and that ultimately the change is felt in the riverflow.

B. E. FERNOW.

WASHINGTON, D. C.

ZOOLOGY AND BIOLOGY.

TO THE EDITOR OF SCIENCE: It is astonishing to find in your columns the assertion, p. 634, that the Johns Hopkins University sends out 'Doctors of Philosophy in Biology,' for you might have learned so easily that no such degree is known among us.

The examining board recommends for the degree of Doctor of Philosophy those students who have satisfactorily completed a course of study which this board has previously approved; and among all those who have been recommended for this degree during the last twenty years not a single one has presented himself for examination in biology, although many have been examined in various branches of biological science.

W. K. BROOKS,

Professor of Zoölogy in the Johns Hopkins University.

BALTIMORE, April 28, 1896.

[The criticism of Professor Brooks is directed against a letter signed by Professor Conway MacMillan, of the University of Minnesota. SCIENCE is not responsible for the opinions of its correspondents. ED.]

THE USE OF THE TOW-NET FOR COLLECTING PELAGIC ORGANISMS.

EDITOR OF SCIENCE: I have so frequently seen the first use of the tow-net as a means for collecting pelagic organisms placed to the credit of Johannes Müller that I suspect many zoölogists are, as I was till recently, ignorant of the fact that Eschscholtz employed the apparatus some twenty years earlier than Müller did.

In Eschscholtz's 'Review of the Zoölogical Collection,' appended to the second volume of 'A new Voyage round the World,' by Otto von Kotzebue, I find the following on page 327: "The calms near the equator afford an abundant harvest to the zoölogist, the tranquil water presenting an immense variety of marine animals to his view, and allowing him to take them with little trouble in a net. The open woolen stuff used for flags offers the most convenient material for making these nets, as it allows the water to run through very quickly and does not stick together. A short wide bag should be made of this stuff, which may be stretched upon the hoop of a cask, and the whole fastened to a long, light pole. From the height on which we stand above the water it is impossible to perceive the smaller animals; the best way, therefore, to catch these is to hold the net half in the water, as if to skim off the bubbles of foam from the surface; then, after a few minutes, if the net is drawn out, and the interior rinsed in a glass of fresh seawater, one may frequently have the pleasure of seeing little animals of strange forms swimming in the glass. In the course of ten days I obtained, in this way, thirty-one different species of animals."

Eschscholtz does not tell us exactly when he began this kind of collecting; but the voyage on which he did it was during the years 1823, '24, '25 and 26; and as the above quotation is taken from the account of his observations in the tropical Atlantic before reaching the coast of Brazil, it certainly relates to the earlier part of the voyage.

In the last one of his series of papers on the development of Echinoderms, published in 1852, Müller tells us that he had used the tow-net 'vielen Jahren mit dem besten Erfolge.' The 'vielen Jahren,' I suppose, refers to the years during which he was prosecuting his beautiful

researches at Heligoland, Trieste and Marseilles, and these he began in 1845.

Very likely other zoölogists as well as Eschscholtz used the tow-net before Müller. One can hardly see how an ardent collector of marine animals could have escaped resorting to something of the kind, even though he had never before seen such a thing.

WM. E. RITTER.

UNIVERSITY OF CALIFORNIA.

SCIENTIFIC LITERATURE.

The Principles of Sociology. By FRANKLIN H. GIDDINGS. Pp. 476+16. Macmillan & Co., New York. 1896.

Sociology has had a checkered and disappointing career. Its study began not because there was a body of men ready to devote their energies to its advancement, but because certain system makers found what they supposed to be a vacant field to which some attention must be given. The men who have done the most from this point of view are Comte and Spencer, though the main interest of neither lay in the development of this field. For these philosophers 'sociology' became the depository of the odds and ends of thought for which no other convenient place could be found. It is needless to say that such a method failed. The creators of a science must live in it, and with this condition these system-makers did not comply.

This new field, this land along the edge of which Comte and Spencer sailed, supposing it to be unoccupied, had residents and tillers. Its aboriginal inhabitants were called economists and, even though not recognized by the system-makers, had really created a science. It is not to be claimed that the whole field was cultivated or even that the occupied portion was cultivated to the best advantage. But work of a permanent character had been done and, at the same time, public opinion had been reconstructed in many important respects. It is the fulfilment of these conditions that justifies the claim of any science.

The second attempt to found a sociology grew out of the shortcomings of these economists. Those who resisted the narrowing tendencies of the definite creed formulated by the economists

found sociology a convenient name and took it to designate their field. But the latter were moved too largely by their sympathies to be scientific workers, and their energies were spent more in denouncing the hard-hearted economists than in formulating better laws. Sociology with them remained, as with the system-makers, a dumping ground for the crude doctrines and rubbish rejected by the economists. Such work and such men could scarcely found a science.

To neither of these causes is due the new American sociology. Professor Giddings is not a wandering philosopher looking for a job, nor is he an outcast economist of the soft hearted variety. Among economists no one has a better reputation. By his good work he has earned a place in their ranks and he leaves them with their hearty good will. The cause of the new movement lies not in personalities nor quarrels, but in conditions—conditions that can be made plain only by a restatement of the history of economic thought.

The science of economics is a product of Eighteenth Century rationalism. By the philosophers of the last century it was assumed that man was a reasonable being. Customs, habits, national feelings and the like were thought to be remnants of past conditions, due to the oppression from which the race still suffered. Conscious calculation should be the only guide; expediency the only rule of action. Each decision was to be made by a summing of utilities. The free man should have only two masters, pleasure and pain.

With such premises the social sciences could be divided into only two parts, economics and utilitarianism. Economics treated of the material sources of pleasure, the influence of the environment on their production and the pains which this production involved. The older forms of ethics, politics and law were to be displaced by utilitarianism, thus including within its scope all decisions where the pleasures and pains were immaterial. Welfare reckoned in material goods was economics; welfare reckoned in units of pleasure was utilitarianism. No rational being should consider other motives, and in time they would disappear through the elevation of the race. While this distinction

between economics and utilitarianism seems logical, it was obliterated by the subsequent development of economics. In the newer economic theories the measurement of welfare in units of satisfaction has displaced the old measurement of welfare in units of commodity. Each material good is valued by the satisfaction its consumption yields, and this satisfaction depends upon the quantity of goods already possessed. This is, in short, the theory of marginal utility which has revolutionized economic thought. It is of importance in the present connection because it destroys the difference between utilitarianism and economics. Utilitarian ethics is but a species of economics. There can be but one science of conscious motives. Conscious calculation is confined to a field where the influence of the environment is direct and where the actions of men are determined by a few dominant motives prompted by pleasure and pain. Perhaps the name economics is not a good one to designate this field, but it has been so monopolized by economists that it will be hard to displace.

Nineteenth Century progress, however, has not justified the hopes of the rationalists of the last century by making economics the only social science. Men have not become mere calculating machines. On the contrary there has been a revival of those modes of thought which seemed moribund. Custom and habit still hold their own; national spirit has shown its vitality in a way that would have astonished the cosmopolitan rationalist; while in law the old standards and customs have endured in spite of the attacks of Bentham. In ethics and religion the revival has been equally notable. What rationalist would have thought that Nineteenth Century ethics would be transcendental, or that its religion would be dominated by Methodism instead of by Unitarianism?

This failure of the utilitarian philosophy is too apparent to be overlooked. It shows that there was some defect in the analysis of its advocates. They assumed that the influences of the physical environment were greater, and the motives of men simpler, than later reflection shows to be the facts. The reasoning of the utilitarians might be saved by admitting a difference between positive and absolute utilities. Positive

utilities are made up of units of pleasure and they can best be secured by conscious calculation. Absolute utilities are, however, necessities upon which life depends and they can best be guarded by strong impulses which compel each man to secure them. In biologic language it might be said that each man and race has certain requisites for survival and certain requisites for welfare. The first group is secured by mental modifications generating strong desires and impulses acting too quickly to admit of calculation. The realm of welfare alone remains open to conscious motives and here the rationalistic attitude is supreme.

It makes little difference what line of reasoning a person uses to convince himself of the inadequacy of the old rationalistic program. The patent fact is that economic philosophy is not the whole science of human nature. Economics has succeeded by its emphasis of a partial man, and to include a study of the whole man in it, as some would have us do, would vitiate its best results. A glance at the history of the other social sciences will show that they have not filled the gap created by the defects in the utilitarian philosophy. Politics in the Aristotelian sense might have been such a science. Its field, however, has been narrowed until it is little more than a history of parliamentary government. Professor Freeman's doctrine, 'history is past politics and politics is present history,' shows how the fields of history and politics have blended. History has developed from a record of kings, battles and dates into a study of institutions. Utilitarian ethics has been absorbed in economics, just as politics has been absorbed in history, while transcendental ethics is more a history than a theory of ethical ideals. Law, like politics, has become a branch of history; its method is comparative and in it pure theory has no place.

It is evident that history is the only branch of the social sciences which has kept pace with economics. These two subjects have been vitalized by Nineteenth Century thought and have grown until, between them, they have absorbed all the social sciences. Only the historical and economic methods of study have been fruitful of results. Students of social

science are either historians or economists, and what is not economics is history. This failure of the other social sciences to develop a theory corresponding to economics has given to sociology its opportunity. Both economics and history will be benefited by a new science including the theoretic elements outside of economics and foreign to history. History cannot become theory without losing its intrinsic qualities, nor can economics absorb social theories without losing its purity and method. The only solution of the difficulty lies in a new theoretic science doing for other portions of social science what economics has done in its field. Economics would then remain a study of the environment and of the simple motives upon which conscious calculation depends. Sociology would give us a theory of human impulses, tradition, imitation and other forms of activity outside of conscious calculation.

There is at present no good word to designate the field outside of utilitarian calculation, and this fact prevents us from seeing its extent and importance. To it our institutions, national life and party feelings belong, as do also the moral, religious and æsthetic ideals of the race and the customs and habits of individuals. These are means of eliminating conscious calculation and through them the promptness, efficiency and regularity of actions are increased. For want of a better term, I am inclined to call all these extra economic elements the *socialry* of the race. I would use this term in so broad a sense as to include every device or habit or motive by which men are united and their activities harmonized. Together they make up a subjective environment which influences the conduct of men fully as much as does the physical environment upon which the economic motives depend. This socialry of men is the subject-matter of sociology, just as their goods are the subject-matter of economics. The latter science treats of the conscious economies due to the simple reactions between the environment of men and their desires; the former treats of the unconscious economies due to heredity and to the psychologic motives which it creates. The two theories supplement one another and when properly harmonized with history would complete the social sciences.

The distinctive merit of Professor Giddings' work is that it is neither economics nor history. It might be denied that he has created a science, but not that he has found a new field and devoted his energies to its exploitation. Too much of the so-called sociology is really disguised economics and elementary biology. The economist recognizes old friends when the sociologist talks of the sustaining system, the circulatory system and the stratification of society. The restatement of old doctrines and ideas may revolutionize a science, but it does not create a new one.

The chapters on Social Population and on the Social Constitution are among the best in the book. It is here that the method of Prof. Giddings shows itself to the best advantage. The problems of anthropology and ethnology are also fully and ably handled. Of the other parts I like best of all the discussion of tradition and of social choices; on these topics he shows the greatest originality. I have not the space to take up these or other doctrines in detail, nor would such work be of much value. A useful book must be read to be understood. A critic can point out merely wherein its value lies and save the student from the heavy burden of reading everything. In this book much more stress is laid on the harmonious relation of the various parts than on particular discussions. Its aim is to interest people in a new science, and in this its success lies. SIMON N. PATTEN.

UNIVERSITY OF PENNSYLVANIA.

Water Supply (considered principally from a sanitary standpoint). By WILLIAM P. MASON, Professor of Chemistry, Rensselaer Polytechnic Institute. New York, John Wiley & Sons. 1896. 504 pp., 8vo.

The subject of the water supply of communities has always been an interesting one, and it has been known for more than two thousand years that the character and amount of sickness and death in a town or city is at times greatly influenced by the quantity and quality of the drinking water of its inhabitants; but it has only been within the present century that any precise and definite information upon this subject has been obtained.

Cholera and typhoid fever epidemics due to a

water supply contaminated with the discharge of a person suffering from one of these diseases have now been observed and recorded in sufficient number, and with enough accuracy, to have convinced both scientific men and the public that this is the most common cause of great outbreaks of these diseases, and that the spread of the specific bacteria which produce them is the means by which such impure waters produce their destructive results. The work of Professor Mason presents abundant evidence of this in the form of statistics of different cities, and of records of individual outbreaks, and gives a fair summary of existing methods of testing and of purifying water supplies. In the chemical part of the book the writer gives his own experience in water analysis, and the directions are clear, concise and well up to date. He confirms Dr. Smart's remarks as to the importance of the rate of evolution of the so-called albuminoid ammonia, in the distillation process, but it is curious that no allusion is made to the fact that the prolonged giving off of albuminoid ammonia indicates, in many cases, the presence of urea, and, therefore, of sewage, in the water.

The chapter on the artificial purification of water is a good summary for the general reader, but it is not made as clear as it should be that, in large sand filtration plants, no single filter bed should exceed a certain size, say one acre, and that the effluent from each filter bed should be tested bacteriologically at least once a week, and in many cases once a day. In other words, a small bacteriological laboratory and the services of a skilled bacteriologist are essential features of such a system of filtration.

Among other epidemics of typhoid fever described is the well known one at Lausen, in which the infected water passed through the base of a mountain, and such passage was demonstrated by adding salt to the water. Flour was also added, and did not pass through, but it is doubtful whether this is a satisfactory proof that the water was really 'filtered' in its passage.

Taking it altogether this is decidedly the best book on water supplies that has yet been produced for American readers and as such it is cordially commended.

SCIENTIFIC JOURNALS.

PSYCHE, MAY.

THE leading article by Prof. V. L. Kellogg gives a general account of the Mallophaga, with a key to the genera. W. S. Blatchley continues his account of the winter Coleoptera of Vigo Co., Ill., and Mr. A. P. Morse his notes on N. E. Tryxalinae. J. W. Folsom examines the types of Packard's *Papirius texensis*, and finds two species among them, one a *Papirius*, the other a new species of *Smynthurus*, which he describes. H. G. Dyar describes the larva of *Cautethia grotei*. T. D. A. Cockerell reviews Dalla Torre's recent catalogue of bees, and F. C. Bowditch gives some notes on the habits of two beetles. Miscellaneous notes complete the number.

THE PSYCHOLOGICAL REVIEW.

THE articles in the May number are researches from the psychological laboratories of Chicago, Harvard and Wisconsin. From Chicago, Prof. Angell and Dr. Moore report on reaction-time experiments in which the attention was alternately concentrated on the attention and on the movement, the stimulus being a sound or a light, and the movement being made with the hand, foot or lips. The reaction-times were on the whole shorter when the alteration was motor, but not to the extent nor with the regularity claimed by the Leipzig experimenters, and the distinction tends to be obliterated or reduced by practice. The authors discuss their results in their relation to attention and habit. In a second research from Chicago, Mr. L. G. Whitehead communicates experiments on visual and aural memory which show that of the thirteen observers tested, ten were able to memorize more rapidly when the series was seen and two when it was heard, while in one case the result was doubtful. Matter memorized aurally appeared to be retained slightly better than that memorized visually.

Dr. Edgar Pierce, now of the University of Michigan, publishes experiments carried out in the Harvard laboratory on the aesthetics of simple forms with special reference to eye movements. He determined the preferences of different observers for figures in different positions,

and concludes that an object satisfies æsthetic demands when the objective conditions fulfill the suggestions aroused by it. Mr. Lough describes a new perimeter made for the Harvard laboratory in which the stimulus is stationery and the fixation point movable.

Mr. F. E. Bolton has repeated and varied, with students at the University of Wisconsin, the experiments on the accuracy of recollection and observation suggested by Prof. Cattell and published in this JOURNAL (Dec. 6., 1895). The scientific students showed greater accuracy of observation and memory than the classical students, and this held even in regard to literary information. The average of the classical students gave 1839 as the date of Victor Hugo's death!

Under Discussion and Reports are given the discussion by Profs. Ladd and Baldwin on consciousness and evolution before the American Psychological Association; Dr. Nichols claims that the existence of specific nerves for pain has been proved; Prof. Herrick writes from his own experience on the testimony of heart disease to the sensory facies of the emotion, and Mr. G. M. Stratton discusses the relation between psychology and logic.

The number concludes with reviews of recent psychological literature, contributed by sixteen writers, and notes.

SOCIETIES AND ACADEMIES.

BIOLOGICAL SOCIETY OF WASHINGTON, 260TH MEETING, SATURDAY, APRIL 18.

WM. H. DALL exhibited two skins of the Glacier or St. Elias bear of Alaska (*Ursus Emmonsii*, Dall), kindly lent for exhibition to the Society by Mrs. Admiral Emmons. He stated that the skins from which the original description in SCIENCE (N. S. II., p. 87, July 26, 1895) was made, were probably summer skins, the hair being shorter and darker than in those shown, which appear to be winter skins, in which the larger part of the hair is white and much thicker and more woolly, the general tint being hardly darker than in the gray wolf of Alaska. These skins had been dressed and trimmed by a furrier, so that the extremities of the head and

limbs were defective, but the peculiar breadth of the head and the remarkable bluish gray coloration of the entire coat indicated an animal specifically distinct from any American bear hitherto known, but more nearly allied to the black than to the brown bears. This opinion, he said, is shared by Dr. Merriam, Mr. True and other students of mammals who have examined them. Earnest efforts are being made to obtain a skull and skin suitable for mounting during the present season.

Under the title *Preliminary Notes on Middle Cambrian Medusæ*, Chas. D. Walcott, of the U. S. Geological Survey, briefly outlined the character and scope of an extended review of the fossil medusæ, prepared by him. He stated that the preliminary announcement of a review of the fossil medusæ of the Middle Cambrian terrane must be modified, as during the last two months the scope of the work had been broadened and a memoir including not only the fossil forms of the Middle Cambrian, but also those of the lower Cambrian and of the Jurassic of Europe, had been practically completed.

A description was given of the mode of occurrence, conditions and manner of preservation, and the interrelations of the fossil and living medusæ, including an account of some interesting experiments that he had made of the phenomena attending the preservation of recent or living forms.

The numerous plates with which the memoir will be illustrated were shown, 45 being devoted to fossil forms and 7 or 8 illustrating the relationship to recent species.

B. E. Fernow described a *Pine Coppice* in New Jersey, being a remarkable area known as the East and West Plains of nearly 15,000 acres extent, covered with a growth of *Pinus rigida*, sprouting from the stump.

In spite of the poor, shallow, sandy gravel soil with an impenetrable subsoil, hardpan and bog ore underlying it and a periodic recurrence of fires, these pines maintain themselves in a regular coppice. Among the specimens exhibited there was a root bearing two sprouts which had evidently been developed into trees one after the other, the older burnt out, the younger showing 83 years of growth, pointing to a persistence of the root of probably over 150 years.

Since the sprouting from the stump of conifers, especially pines, is most unusual and at least the persistence of the sprouts has generally been doubted, this exhibit under the specially unfavorable conditions cited is of great interest.

The well-observed capacity of the species to develop adventitious buds seems here to serve for the purpose of maintaining the occupancy of the soil. Cones develop on 3 to 5-years-old sprouts, but germinative seeds are rarely found.

F. A. LUCAS,
Secretary.

GEOLOGICAL SOCIETY OF WASHINGTON.

At the 43d meeting, held in Washington, D. C., April 22, 1896, communications were presented as follows: 'A new Laccolite Locality in Colorado and Its Rocks,' by Mr. G. K. Gilbert and Mr. Whitman Cross; 'The Origin of some Mountain Scarps,' by Mr. M. R. Campbell.

Mr. Gilbert described a laccolitic locality discovered last summer in southern Colorado. Dakota and older rocks are bent into a dome with a height of 1,000 feet and a width of 5 miles. Many dikes traverse this and two laccolites are exposed in partial section. The horizons of intrusion are more than 600 feet below the base of the Dakota. The date of intrusion is approximately indicated as Eocene or late Cretaceous. The intruded rock is more basic than is ordinarily found in laccolites and is much more easily disintegrated by weathering. The neighboring sandstones and those portions of neighboring shales which have been baked by the intrusions resist erosion better than the igneous rocks, so that the laccolites find topographic expression in valleys instead of hills. A mass of altered sandstone, protecting a pedestal of shale and igneous rock, stands prominent above the country, constituting the crest of Twin Butte, the most conspicuous landmark of the region.

The rocks of the laccolite and dikes were described by Mr. Whitman Cross. The rock of the laccolite and of most of the dikes is a basic syenite porphyry, in which the ferromagnesian silicates, augite, biotite and olivine, exceed the feldspathic constituent. Augite is the predominant silicate. These rocks are allied to a large series from the plains of Colorado and New Mexico, to be described hereafter.

Mr. M. R. Campbell discussed the origin of the eastward facing scarp of the Blue Ridge throughout North Carolina, which has been attributed (1) to the action of sea waves on an elevated coast, (2) to the normal erosion of a broadly uplifted peneplain, and (3) to deformation produced by radial movements in the crust of the earth. The first and second theories he regarded as obsolete or insufficient. The third theory seems to offer the best explanation, but deformation alone could hardly produce the present scarp; there seems to have been modifying conditions which have not heretofore been formulated, but which were probably the immediate cause of the scarp production.

No radial movement is known to have occurred in the Appalachians of sufficient intensity to produce so steep a scarp, but if, during a period of baseleveling, a slow monoclinical uplift occurs, the portion of the region which is beyond the influence of the uplift will remain at baselevel, whereas in that portion in which the movement is at a maximum the process of baseleveling will be interrupted producing a very different succession of topographic forms. There will be an intermediate zone in which the forces of elevation and degradation will be balanced against each other.

If the movement is relatively rapid the peneplain will encroach but slightly upon the uplift. If the movement is slow the peneplain will encroach to a much greater extent not only along the streams, but in the inter-stream areas also. The result of this encroachment is to accentuate the slope produced by the uplift, and if the movement is extremely slow the slope will become a scarp.

If this hypothesis is correct the peneplain which caps the Blue Ridge is continuous with the Piedmont plain at a very short distance from the foot of the ridge, but the intermediate, or sloping, portion of the old peneplain is almost completely removed by more recent erosion along the zone of tilting.

In the vicinity of Roanoke, Va., this uplift turned toward the north and crossed the Appalachian valley. In this portion of its course similar results were produced, but the rocks are not hard enough to preserve the scarp as

they do further south. In crossing the Appalachian valley this uplift protected the basin of New River against the encroachment of the Atlantic streams, which otherwise would, doubtless, have captured its headwaters. In this region also some of the tilted portion of the older peneplain is probably preserved in an intermediate level which some observers have classed is a distinct peneplain.

It seems probable that in other regions local uplifts have occurred during the continuance of periods of extensive baseleveling, and if so similar forms have probably been produced.

W. F. MORSELL.

U. S. GEOLOGICAL SURVEY.

ACADEMY OF NATURAL SCIENCES OF PHILADELPHIA, APRIL 21.

MR. LEWIS WOOLMAN described the imbedded trees in the cedar swamps of Cape May Co., N. J., from which cedar shingles are manufactured. The lumber men distinguish two kinds of logs: those from 'windfalls' or trees overturned with their roots and 'breakdowns' or those broken off by the wind or other agency. The wood of the former is always well preserved, while that of the 'breakdowns' is not generally in as good condition. From a sound trunk 32 feet long 4,000 cedar shingles have been cut. The tree contained upwards of 800 rings of growth, and the wood when cut emitted a distinct odor.

Mr. A. E. Brown stated that he had recently had an opportunity of examining in the British Museum a cast of the portion of a skull of *Pithecanthropus erectus* discovered by Dr. Dubois. An examination of the cast supports the opinion advanced by Cope and Allen before the Academy that the remains as described and figured by Dubois present no characters separating the species from *Homo Neanderthalensis*. The Java skull is possibly a little flatter than the Neanderthal specimen, but this is purely individual and is compensated for by a bump over the coronal suture. It is also a little more inflated postero-laterally, the supra-orbital ridges being perhaps not quite so thick, although they project as much, if not more. The Java skull is about five-sixths or seven-eighths the length of the other, the cubical capacity being somewhat less.

The phylogeny of man and the apes was considered by Messrs. Rothermell, Brown and Chapman.

Anthropological Section, April 10. Charles Morris, Recorder. Prof. Witmer made a communication on the relations of modern psychology to anthropology. Numerous examples were adduced to illustrate the connection between psychic and physical action, modern psychology beginning with a study of sensation rather than movement. The law of Fechner and Weber, that if stimuli increase in arithmetical proportion, sensation will increase in geometrical proportion, was, although repudiated by physiologists generally, held by the speaker as furnishing an index of discrimination and indicating methods by which we can distinguish and measure individual responsiveness to various stimuli. Devices for registering and measuring psychical responsiveness were described.

The subjects of psycho-neural tests, temperaments and the effects of stimuli on unconscious movement were discussed by Messrs. Kavanaugh, Mills, Allen, Witmer and Reisman.

Botanical Section, April 13. Dr. Charles Schaeffer, Recorder. Mr. Lippincott presented a specimen of *Grindelia squamosa*, a Western plant, collected at Swedesboro', N. J. He also read a paper on the propagation of orchids.

A paper on the varieties of bacteria, their cultivation and their life history was read by Dr. Rabinowitsch.

Dr. Ida Keller exhibited the effect of chlorine in changing the blue color of a *Cinneraria* to pink due to the formation of hydro-chloric acid in the petals. The experiment was made in connection with a consideration of the acid or alkaline contents of vegetable cells.

EDW. J. NOLAN,

Recording Secretary.

GEOLOGICAL CONFERENCE OF HARVARD UNIVERSITY, APRIL 7, 1896.

Ice Phenomena in Green Bay, Lake Michigan.

By E. P. CAREY.

The Great Lakes offer an interesting field for the study of ice action under the influence of the wind, especially at the head of Lake Superior in the vicinity of Duluth, and in Green

Bay, at the west of Lake Michigan, from which it is almost entirely shut off except a very narrow strait called the 'door.'

At these two localities the effects are quite different. Mr. D. J. Woolman, of Duluth, states that at the head of Lake Superior the ice, which has formed in early winter some distance out from the shore, usually soon becomes broken up by easterly or westerly winds and is subsequently piled up by the wind in a ridge several feet high along the shore. In later winter the ice freezes more deeply and so becomes frozen to the bottom for some distance out from the shore. Beyond this limit of freezing the outer ice again becomes broken up by the wind, and in a similar way another ridge of ice is formed a few rods from the shore, roughly parallel with the first ridge, and enclosing a sheet of smooth ice. In this way two or more ridges of ice are formed parallel with the shore.

In Green Bay, however, the effect is quite different. The Bay is almost entirely shut off from Lake Michigan and in winter becomes entirely frozen over, and after once freezing over the ice is rarely broken up to any extent by the wind. On the other hand, a strong wind from the west or northwest sometimes has the effect of causing the ice to move shoreward in the direction of the wind, as a solid sheet, thus piling it up along the shore to a depth of sometimes sixty feet or more. A movement of this kind generally occurs at least once during a winter, and is fully accomplished in from *one to three* minutes.

In this way considerable geological work is done along the shore, and it is not uncommon to see, after the ice melts in spring, a pile of shore debris piled up in places to a height of eight feet, and showing features characteristic of moraines. The amount of geological work done at different points along the shore differs and at any point seems rather to depend on the slope of the shore and conditions other than the ice movement at that point, *e. g.*, at the point where the maximum amount of ice movement occurred the minimum amount of work was done. Here the conditions were these, *viz*: A steep slope just at the shore line, which must have had the effect of causing the

ice to break almost as soon as it began to move. Along the shore about eight feet from the original ice front, stood a pile of slabs, piled loosely to a height of ten feet, and parallel with the shore so as to directly oppose the advance of the ice. These slabs, however, though completely buried for many feet by the ice which pushed up over and beyond them, were nevertheless scarcely disturbed. As the ice became broken at the shore line the pieces filled in between the shore and the slabs so that the ice following pushed up over the ice already deposited there, leaving the slabs practically intact.

T. A. JAGGAR, JR.,
Recording Secretary.

PROCEEDINGS OF THE TORREY BOTANICAL CLUB.

THE Club met on Tuesday evening, April 9, 1896, President Addison Brown in the chair, and 30 persons present. Two new members were elected.

Dr. Albert Schneider read a paper on 'The Uses of Lichens,' giving an instructive account of the past and present uses of these plants in medicine and the arts. Mr. P. A. Rydberg read his announced paper entitled 'Preliminary Notes on a Revision of the North American species of *Potentilla* and Related Genera.' This was accompanied by many herbarium specimens and drawings, and drew forth remarks from the President and Mrs. Britton.

The last paper was that of Mrs. E. G. Britton, on 'Notes on Mexican Mosses.' Mrs. Britton gave a short historical account of the various collections of mosses which have been made in Mexico, stating that she had recently received, for naming, the specimens gathered by Pringle, as well as those collected in 1892 by Smith and Brunner. Specimens from these two collections, as well as others from those of F. Müller, C. Mohr, Hahn, etc., were exhibited, and a comparison was made of the number of genera and species which are common to Mexico and the United States.

The President reminded the members of the first Field Day of the season, April 25th, at Prince's Bay, S. I.

W. A. BASTEDO,
Secretary pro tem.